

Netherlands
organization for
applied scientific
research

FEL

TNO Physics and Electronics
Laboratory

AD-A236 521

TD 91-2189



report no.
FEL-90-A368

8

Meteo and irradiation data during BEST TWO,
Mourmelon

TDCK RAPPORTCENTRALE
Frederikkazerne, Geb. 140
van den Burchlaan 31
Telefoon: 070-3166394/6395
Telefax : (31) 070-3166202
Postbus 90701
2509 LS Den Haag TDCK

①

DTIC
ELECTE
JUN 07 1991
S B D

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

91 0 5 0128

91-01282



TD

Netherlands
organization for
applied scientific
research

TNO-report



TNO Physics and Electronics
Laboratory

P.O. Box 96
2509 JG Tr
Oude Waals
The Hague, The Netherlands
Fax +31 70 328 09 61
Phone +31 70 326 42 21

TD

report no.
FEL-90-A368

copy no.

8

title

Meteo and irradiation data during BEST TWO,
Mourmelon

1

Nothing from this issue may be reproduced
and or published by print, photoprint,
microfilm or any other means without
previous written consent from TNO.
Submitting the report for inspection to
parties directly interested is permitted.

In case this report was drafted under
instruction, the rights and obligations
of contracting parties are subject to either
the 'Standard Conditions for Research
Instructions given to TNO' or the relevant
agreement concluded between the contracting
parties on account of the research object
involved.

TNO

author(s):

Ir. Y.H.L. Janssen

date :
April 1991

DTIC
ELECTE
JUN 07 1991
S B D

classification

title : unclassified
abstract : unclassified
report text : unclassified
appendix A : unclassified

no. of copies : 33
no. of pages : 43 (incl. appendix,
excl. distr. list & RDP)
appendices : 1

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

TDCK RAPPORTENCENTRALE
Frederikkazerne, Geb. 140
van den Burchlaan 31
Telefoon: 070-3166394/6395
Telefax: (31) 070-3166202
Postbus 90701
2509 LS Den Haag

TDCK

All information which is classified according to
Dutch regulations shall be treated by the recipient in
the same way as classified information of
corresponding value in his own country. No part of
this information will be disclosed to any party.



91-01282



report no. : FEL-90-A368
title : Meteo and irradiation data during BEST TWO, Mourmelon

author(s) : Ir. Y.H.L. Janssen
institute : TNO Physics and Electronics Laboratory

date : April 1991
NDRO no. : A90KL621
no. in pow '90 : 716

Research supervised by: Ir. A.N. de Jong
Research carried out by: Ir. Y.H.L. Janssen, P.J. Fritz

ABSTRACT (UNCLASSIFIED)

In August 1990 the BEST TWO experiments were held at Camp Mourmelon, organised by NATO AC243 P04 RSG15 group.

During their measuring periods the research group infrared (IR) of FEL TNO (Netherlands) collected several meteo and irradiation data for support and validation of their transmission, visual and infrared contrast experiments.

Meteo data consist of ambient temperature, relative humidity and windspeed. Visual hemispherical radiation on a horizontal surface is measured together with visual radiation on five sides of a cube (top and four vertical sides) and visual irradiation on three boards with elevation angles of 90, 60 and 30 degrees. For support of experiments in the infrared wavelength range, apparent temperatures of a vertical black and white board were measured.

DTIC
COPY
INSPECTED
5

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

rapport no. : FEL-90-A368
titel : Meteo- en stralingsdata tijdens BEST TWO, Mourmelon

auteur(s) : Ir. Y.H.L. Janssen
instituut : Fysisch en Elektronisch Laboratorium TNO

datum : april 1991
hdo-opdr.no. : A90KL621
no. in iwp '90 : 716

Onderzoek uitgevoerd o.l.v.: Ir. A.N. de Jong
Onderzoek uitgevoerd door: Ir. Y.H.L. Janssen, P.J. Fritz

SAMENVATTING (ONGERUBRICEERD)

In augustus 1990 zijn in Camp Mourmelon de BEST TWO experimenten gehouden, georganiseerd door de NATO AC243 P04 RSG15 groep. De groep infrarood van het FEL TNO heeft tijdens haar meetsessies meteo- en stralingsdata verzameld, ter ondersteuning en validatie van ondermeer transmissie, visuele en infrarood contrast experimenten.

Als metedata zijn luchttemperatuur, relatieve vochtigheid en windsnelheid verzameld. De visuele hemisferische zonne- en omgevingsstraling die invalt op een horizontaal vlak is gemeten naast de visuele straling die invalt op vijf zijden van een kubus, de top en de vier verticale zijden. Verder is de hoeveelheid straling bepaald die invalt op vlakken met elevatiehoeken van 30, 60 en 90 graden. Voor ondersteuning van de experimenten in het infrarood zijn de schijnbare temperaturen van een verticale witte en zwarte plaat gemeten.

ABSTRACT	2
SAMENVATTING	3
CONTENTS	4
1 INTRODUCTION	5
2 INSTRUMENTATION AND SET UP	6
2.1 Instrumentation	6
2.2 Set up	8
2.3 Data collection	12
2.4 Measuring days and times	12
3 RESULTS	13
4 REFERENCES	32
APPENDIX A: PLOTTED METEO DATA	

1 INTRODUCTION

Measurements performed by the researchgroup infrared (FEL TNO, Netherlands) dealt mainly with the following BEST TWO objectives (BES90):

- determination of the effectiveness of electro optical EO systems under adverse European atmospheric conditions with and without battlefield events
- examination of the effects in the near and far fields of single and multiple emissive sources and transient events
- collecting data on the acquisition of static and moving ground vehicles in natural clutter conditions with and without battlefield events in a European environment at ranges out to 4 km

The experiments performed by the group infrared concerned:

- Multipath Transmission Radiometer measurements (MPTR)
- Minimum Resolvable Temporal Difference measurements (MRTD)
- infrared contrast and target signature experiments (IR-18 camera)
- visual contrast and target signature experiments (CCD-camera)

On these experiments will be reported separately. To be able to validate these experiments properly it was necessary to collect some background data. These background data, presented in this report, can be divided in three main parts:

1. meteo data
2. irradiation data
3. apparent temperature data

Meteo data consist of ambient temperature ($^{\circ}\text{C}$), relative humidity (%) and windspeed (m/s). Irradiation data consist of hemispherical irradiation (W/m^2) incident on a horizontal plate, irradiation incident on plates with elevation angles of 90, 60 and 30 degrees and irradiation incident on five sides of a cube (top and four vertical sides with orientation SE, SW, NW and NE). Apparent temperatures are collected from vertical white and black boards.

The meteo and radiation set up was realised by J.J. van der Ende, A. Offerman and P.J. Fritz. Operation of the sensor was carried out by W. van Bommel. All data were gathered and plotted together with P.J. Fritz. All participants are greatly acknowledged for their contributions.

2 INSTRUMENTATION AND SET UP

2.1 Instrumentation

Meteorological data:

Ambient temperature is measured by a platinum resistance (W. Lambrecht, K.G. Gottingen). Relative humidity is determined by a hydrometer and windspeed is measured by a windspeed sensor (H. Goldbrunner, D. Neckor). These meteorological data are collected by a meteostation (for more detailed information see DRE).

Irradiation data:

To determine the hemispherical radiation on a horizontal surface, radiation was measured by a solarimeter (Kipp & Zonen, CM5). The solarimeter consists of a thermopile covered by a head of bold glass (Scott K5). The 50% intensity spectral range is between 305 and 2800 nm.

To determine the radiation on a surface with certain slope and direction, irradiance is measured with a BPW34 photodiode covered by a Wratten 89B filter. Spectral transmittance of both sensor and filter are shown in figure 2.1.

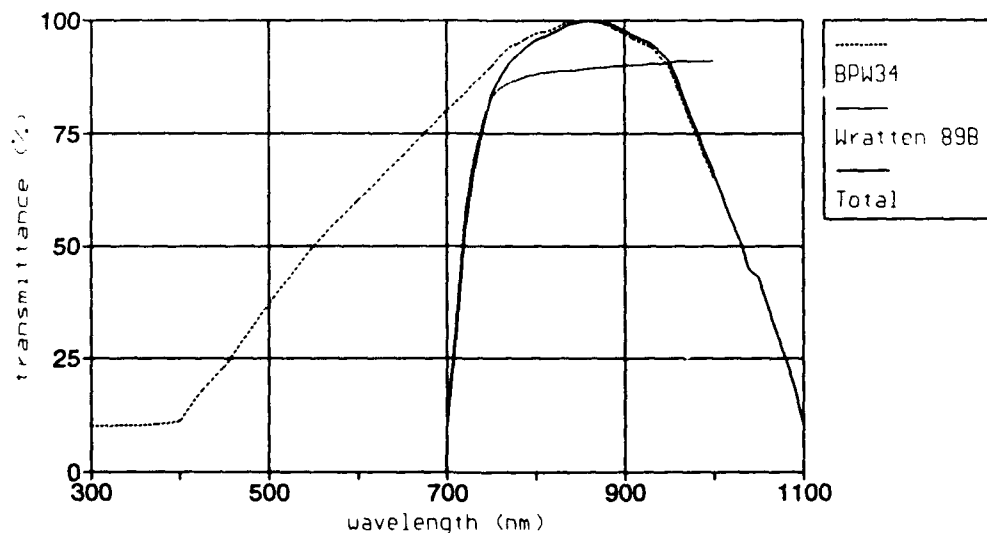


Fig 2.1: Transmittance of BPW34 photodiode, Wratten 89B filter and total transmittance.

Apparent temperature data:

Apparent temperatures are determined by radiometers covered with two filters. The total spectral range is between 2 and 16 μm . Figure 2.2 shows the total relative response of radiometers with filters.

Filter

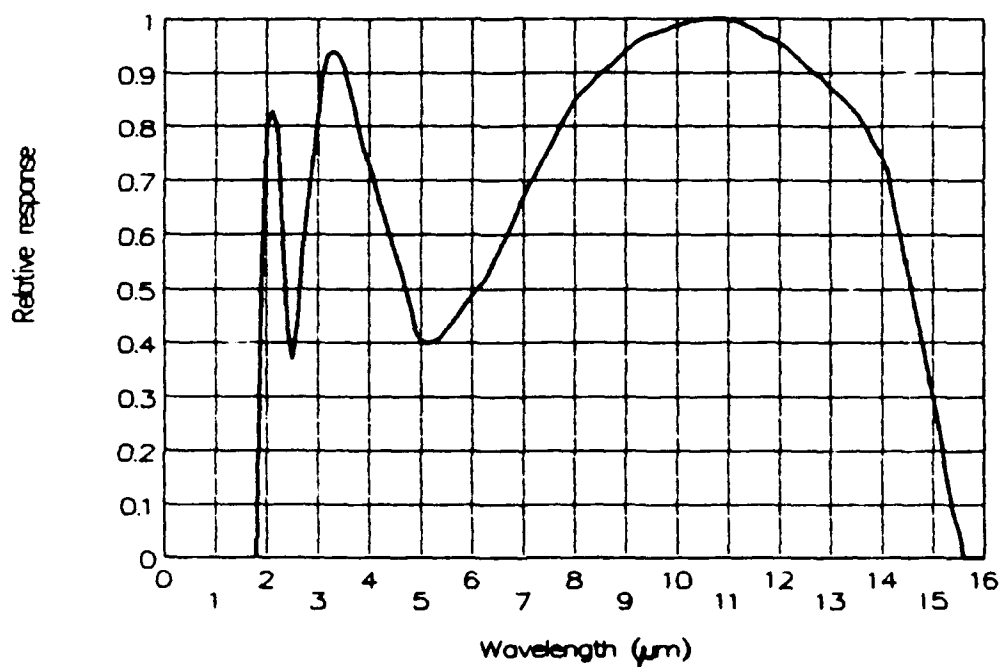


Fig 2.2: Relative response of radiometers with filters.

2.2 Set up

Meteo, irradiation and apparent temperature data were collected at a distance of about 2.5 km from the main instrumentation area. Coordinates and orientation of the instrumentation area are shown in figures 2.3 and 2.4.

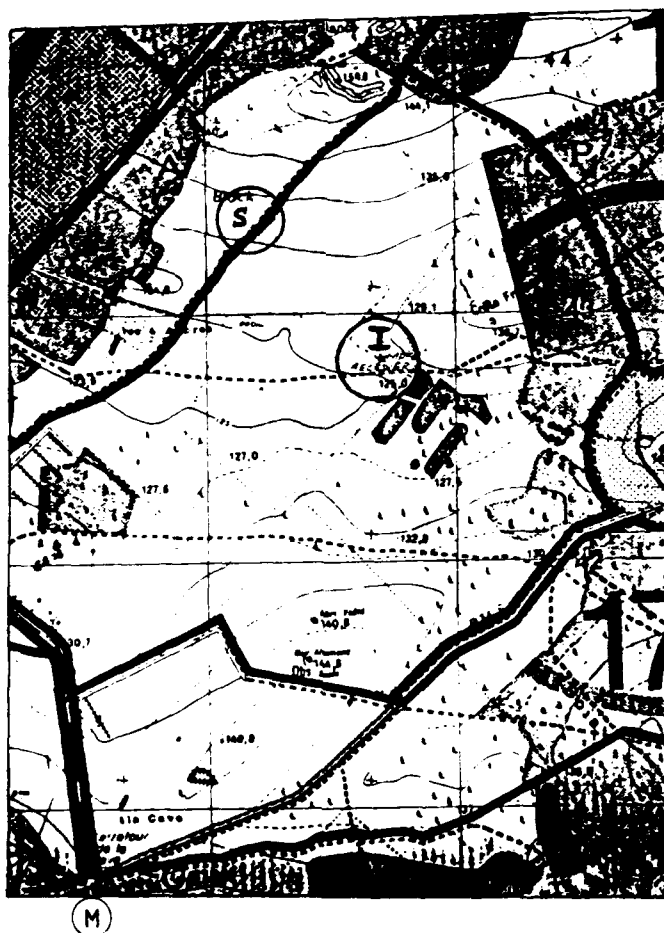


Fig 2.3:

Position of set up on camp Mourmelon
with: I: set up measurements group IR FEL-TNO
M: main instrumentation area
S: set up meteo and radiation data

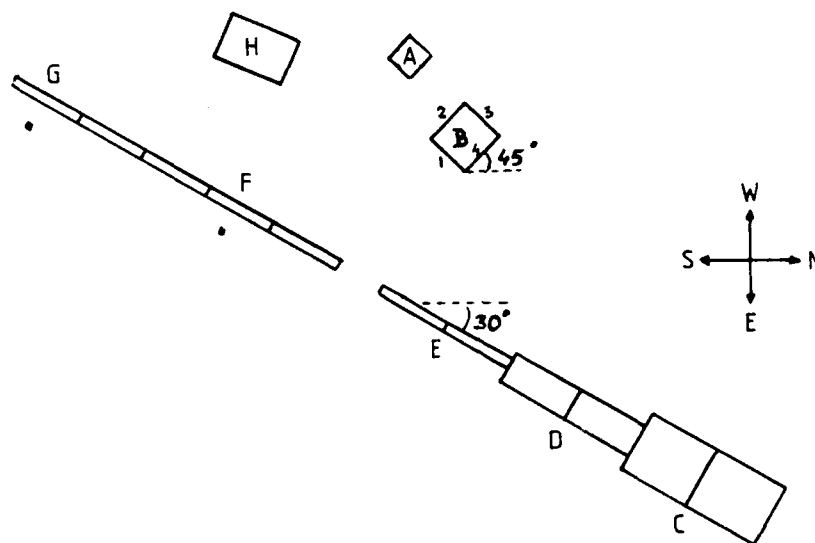


Fig 2.4: Top view and orientation of instrumentation set up
 with: A: meteobox
 B: cube for measuring radiation in five perpendicular directions
 C,D,E: boards for measuring radiation under elevation angles of
 respectively 30, 60 and 90 degrees
 F,G: measuring of radiation temperatures of respectively vertical black and
 white boards
 H: data storage

Meteo data are measured 1.5 m above ground level and at a distance of at least 2 m from the nearest obstacle. The solarimeter is placed at the top of the meteostation. Irradiation in five perpendicular directions is measured with a photodiode and filter on each side of the cube, except the bottom. The box and its orientation (top, SE, SW, NW and NE) are shown in figure 2.4.

Position and orientation of the white and black boards (measuring apparent temperatures) and the boards with different elevation angles are shown in figure 2.4 and photos 2.5a and 2.5b.

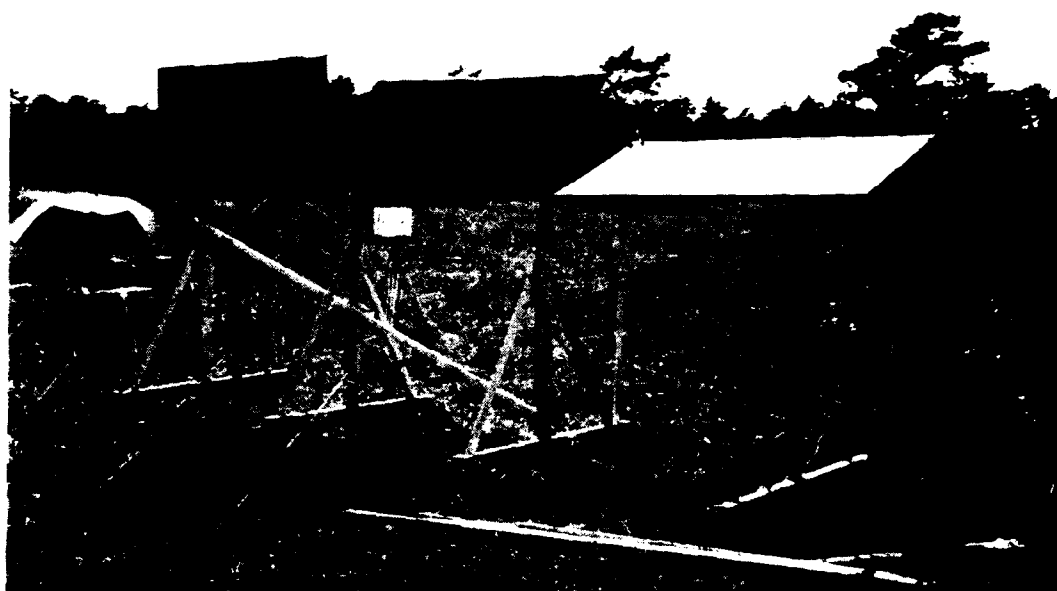


Photo 2.5a: Boards under different slopes for measuring irradiation.

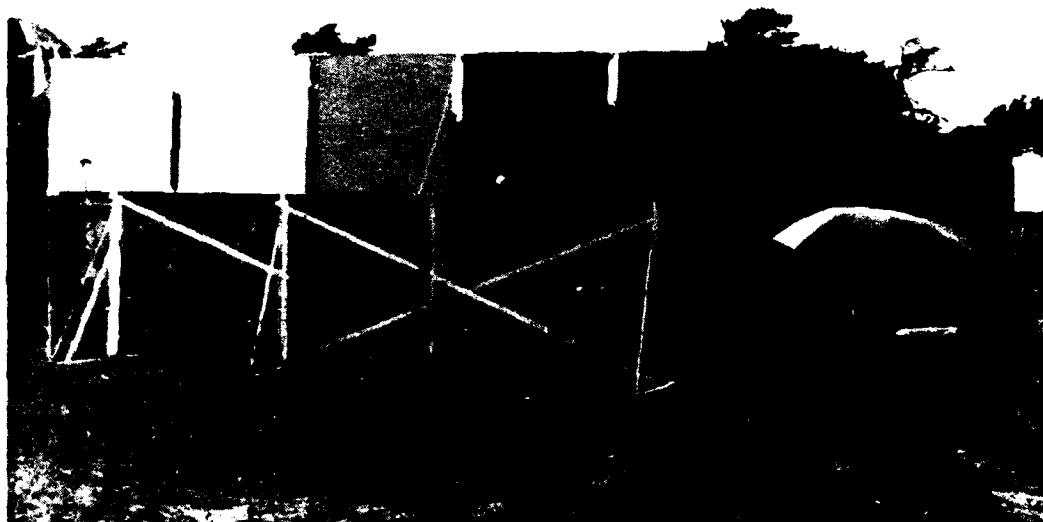


Photo 2.5b: White and black boards for measuring radiation temperatures.

2.3 Data collection

The measuring units are selfregistering. Meteo data are registered every 10 seconds and send to a plotter and a PC. Irradiation and apparent temperature data are digital stored on a PC every 10 seconds and their average values are calculated and stored every 15 minutes.

2.4 Measuring days and times

date (DD-MM-YY)	time (HH:MM)
30-07-1990	09:00 - 18:00
31-07-1990	08:30 - 24:00
01-08-1990	10:30 - 17:00
02-08-1990	02:00 - 14:30
03-08-1990	08:30 - 12:30
06-08-1990	09:00 - 17:00
07-08-1990	09:30 - 16:00
08-80-1990	02:45 - 12:00
09-08-1990	09:30 - 16:00

3 RESULTS

All data presented in figures 3.1a - 3.4i are values averaged over 15 minutes.

Irradiation data on 5 sides of the cube are shown in figures 3.1a - 3.1i. Irradiation data on boards with elevation angles of 90, 60 and 30 degrees are shown in figures 3.2a - 3.2b. Temperature, relative humidity, windspeed and radiation measured by solarimeter are shown in figures 3.3a - 3.3i. Apparent temperatures of a vertical white and black board are presented together with ambient temperature in figures 3.4a - 3.4i.

Plotted meteo data are presented in appendix A. Differences between plotted data and stored data on a PC are caused by different average times.

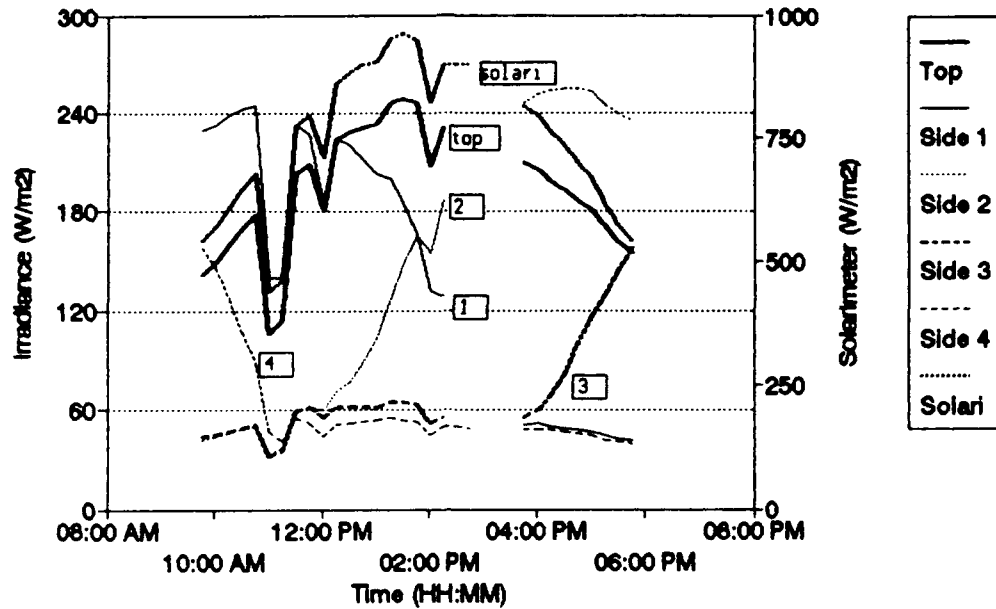


Fig 3.1a: Irradiation at five sides of a box; 30-07-1990.

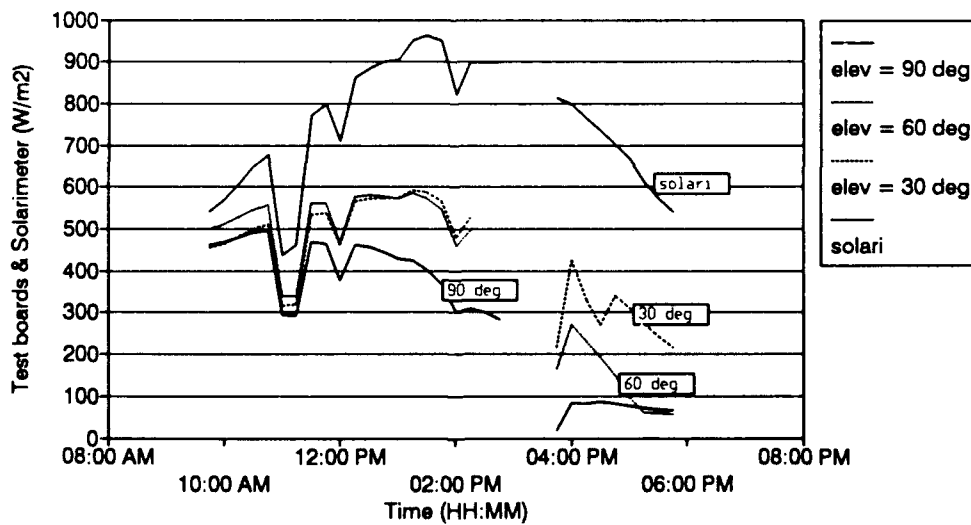


Fig 3.2a: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 30-07-1990.

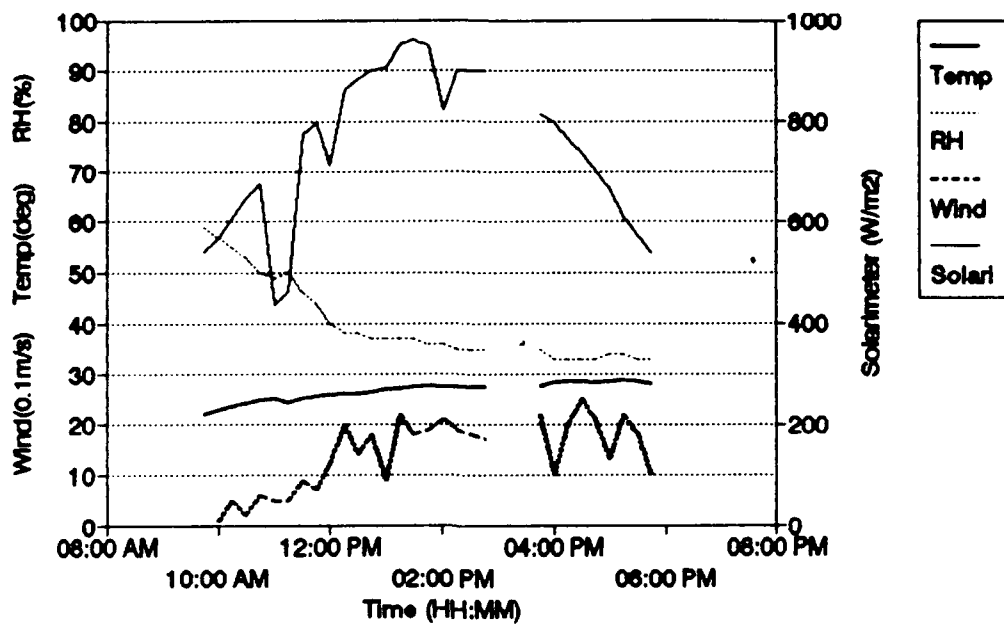


Fig 3.3a: Temperature, relative humidity, windspeed and hemispherical radiation; 30-07-1990.

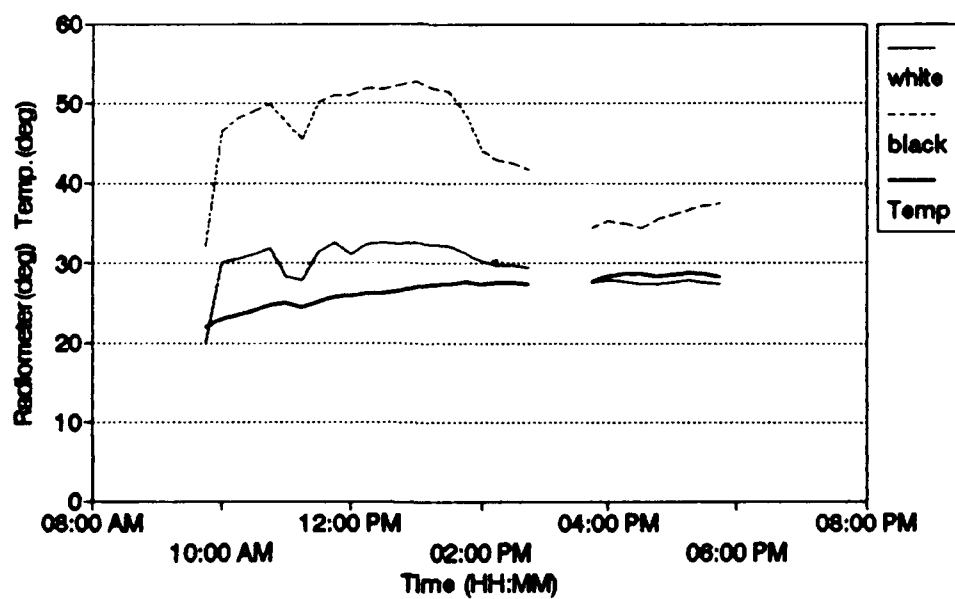


Fig 3.4a: Apparent temperature of vertical black and white board, ambient temperature; 30-07-1990.

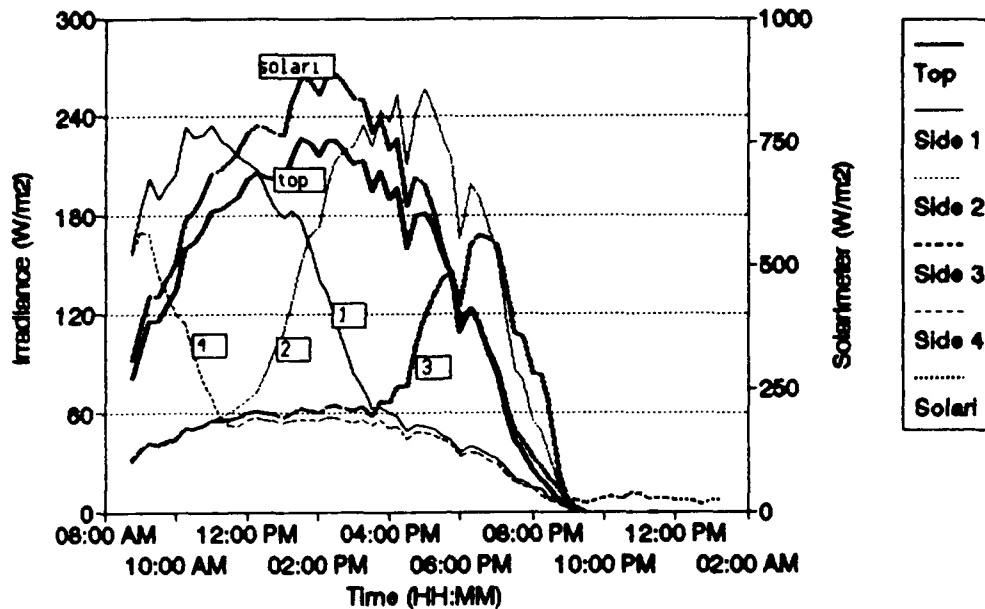


Fig 3.1b: Irradiation at five sides of a box; 31-07-1990.

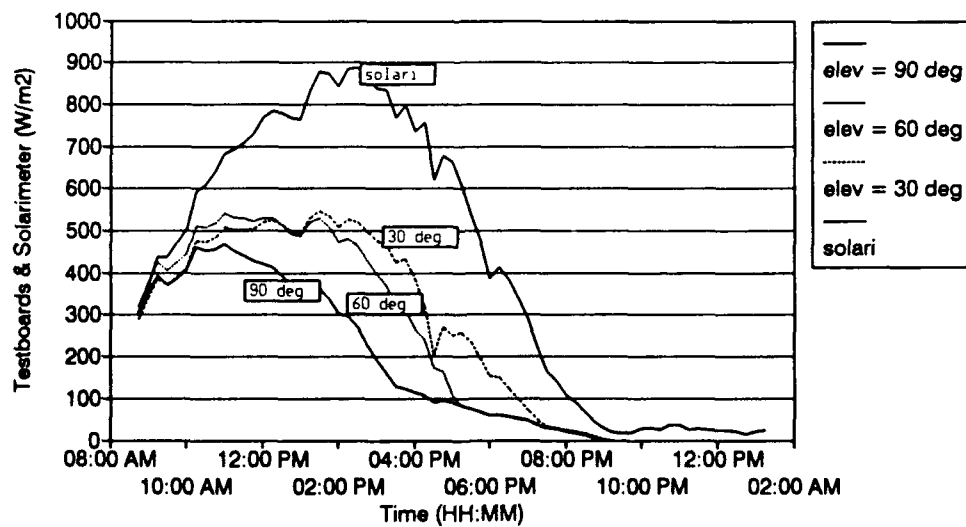


Fig 3.2b: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 31-07-1990.

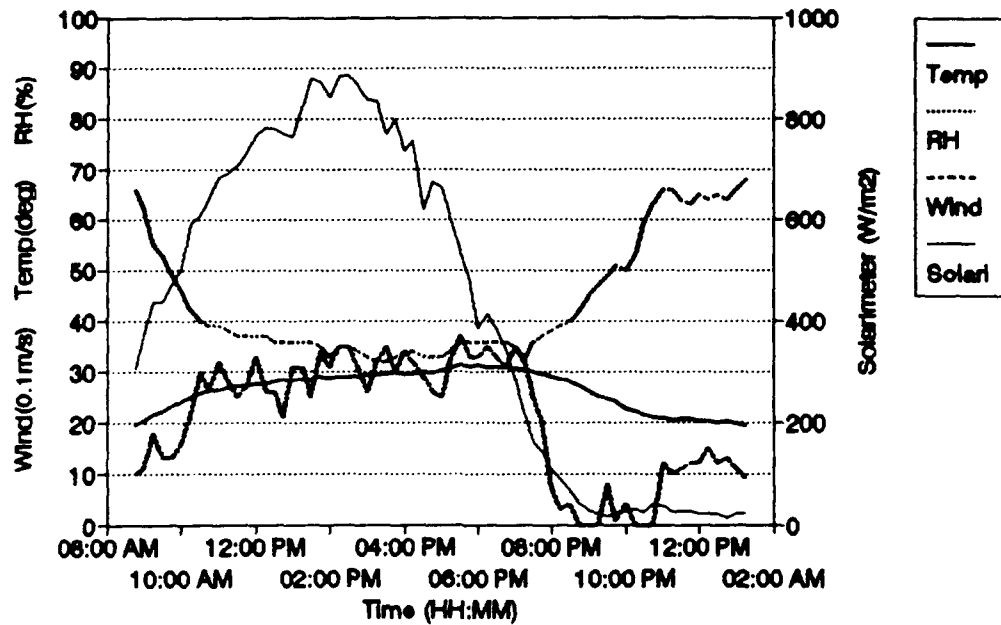


Fig 3.3b: Temperature, relative humidity, windspeed and hemispherical radiation; 31-07-1990.

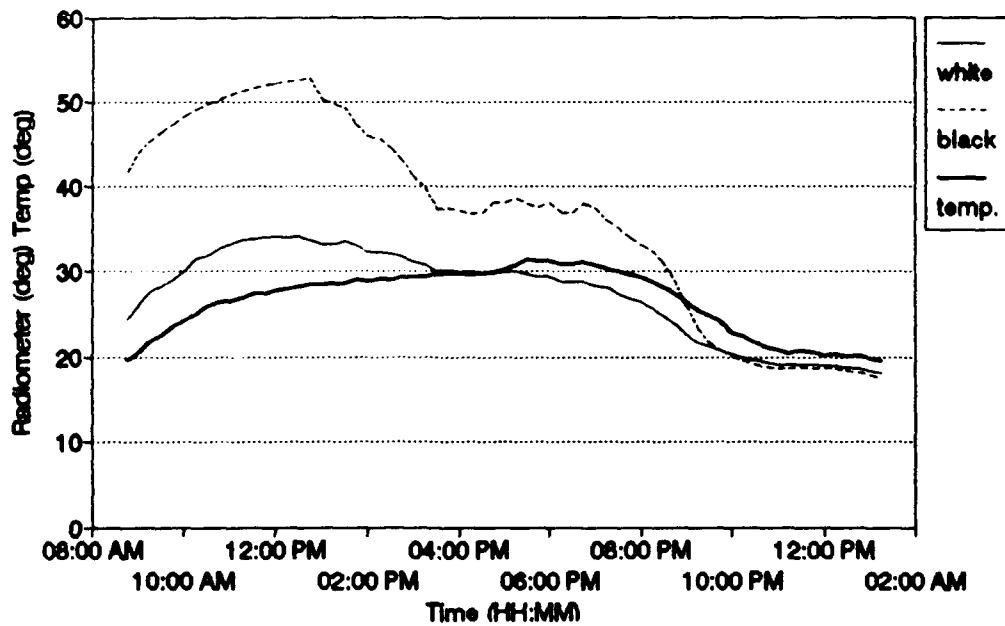


Fig 3.4b: Apparent temperature of vertical black and white board, ambient temperature; 31-07-1990.

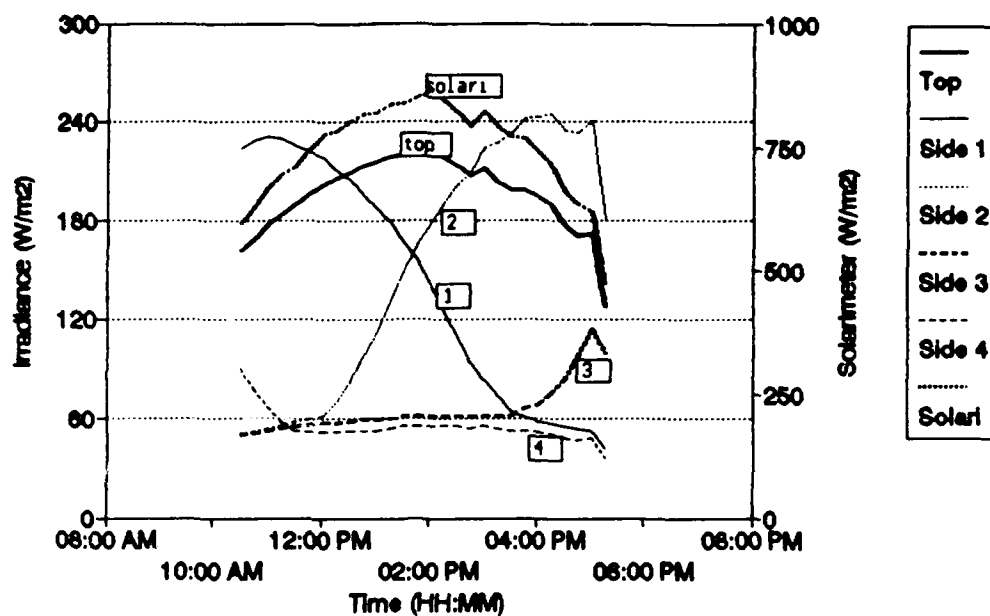


Fig 3.1c: Irradiation at five sides of a box; 01-08-1990.

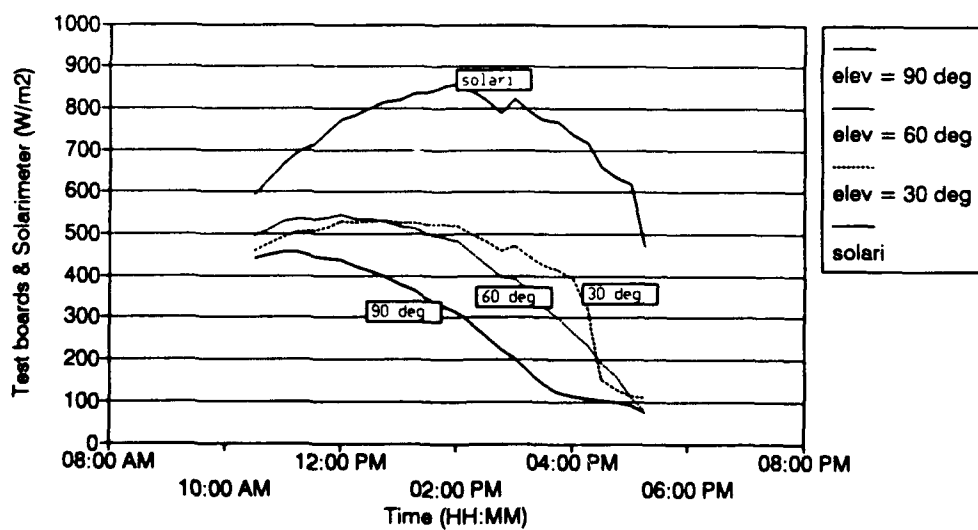


Fig 3.2c: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 01-08-1990.

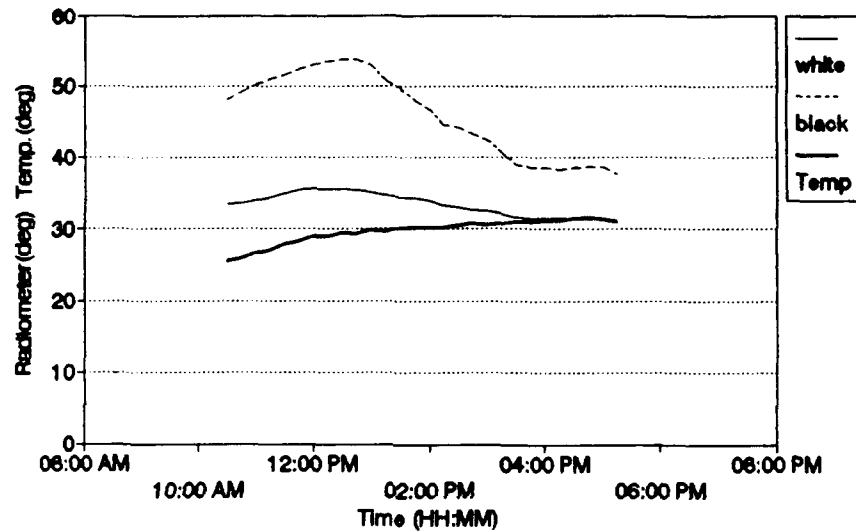


Fig 3.3c: Temperature, relative humidity, windspeed and hemispherical radiation; 01-08-1990.

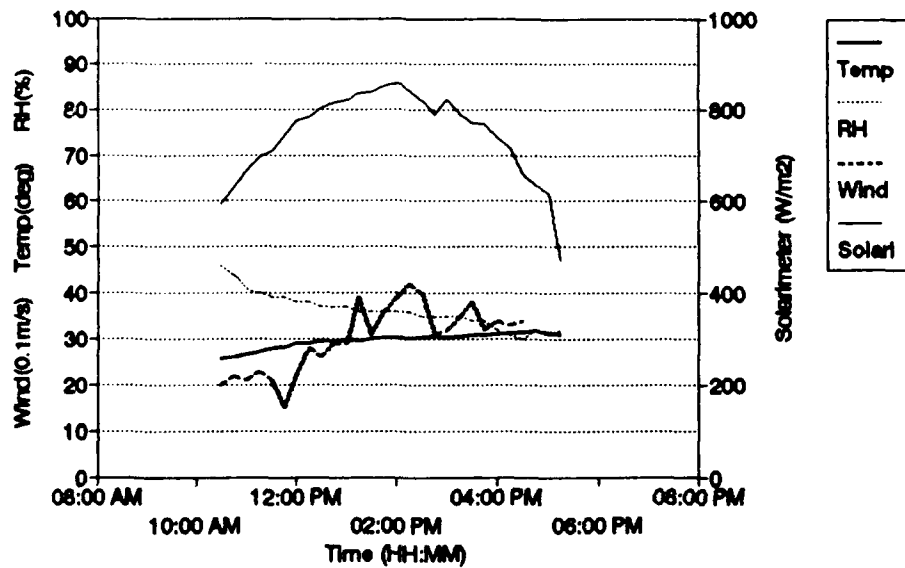


Fig 3.4c: Apparent temperature of vertical black and white board, ambient temperature; 01-08-1990.

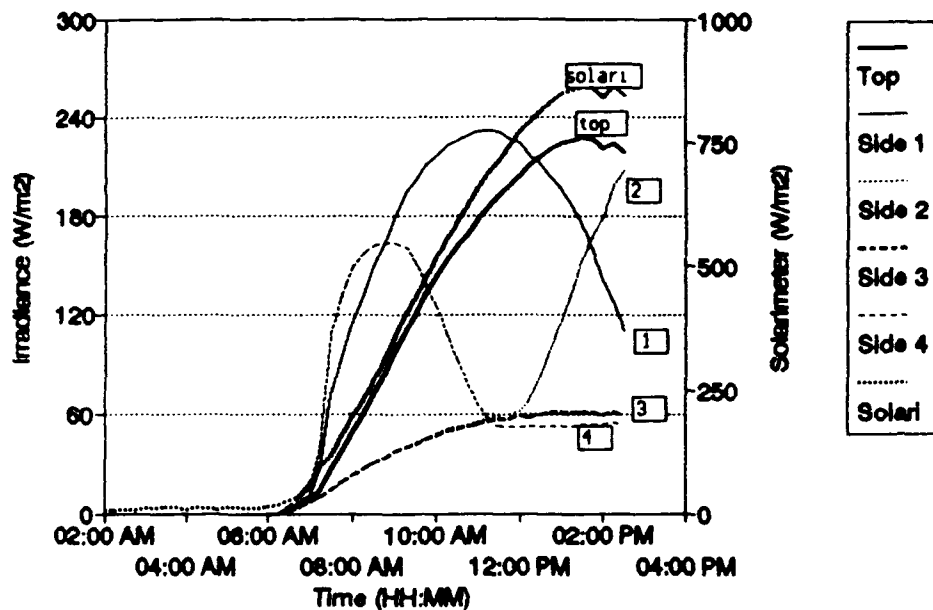


Fig 3.1d: Irradiation at five sides of a box; 02-08-1990.

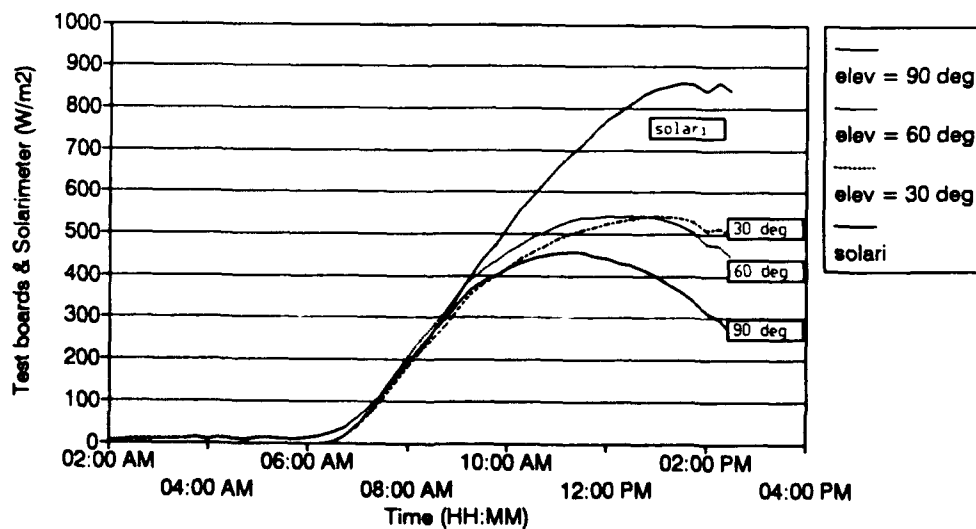


Fig 3.2d: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 02-08-1990.

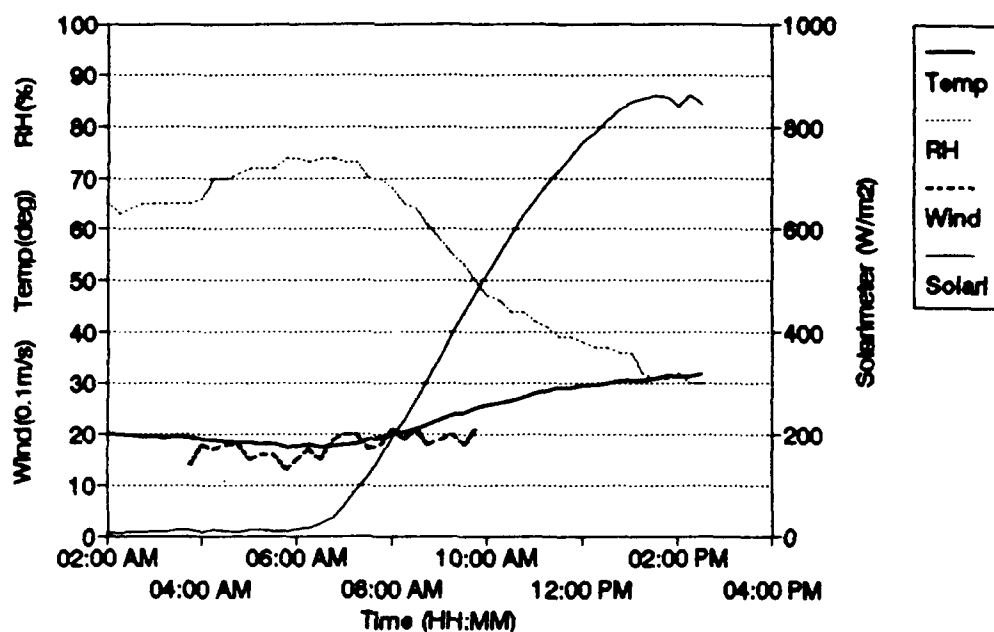


Fig 3.3d: Temperature, relative humidity, windspeed and hemispherical radiation; 02-08-1990.

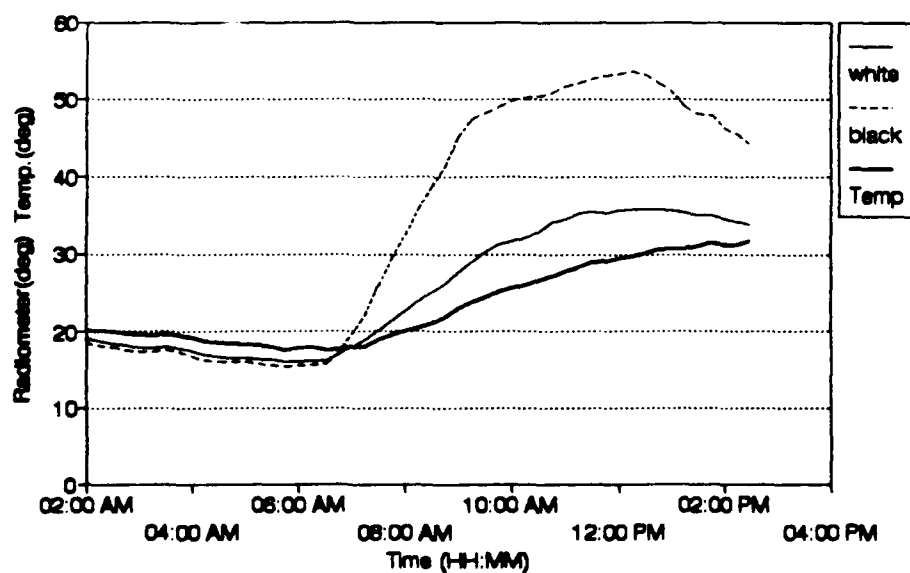


Fig 3.4d: Apparent temperature of vertical black and white board, ambient temperature; 02-08-1990.

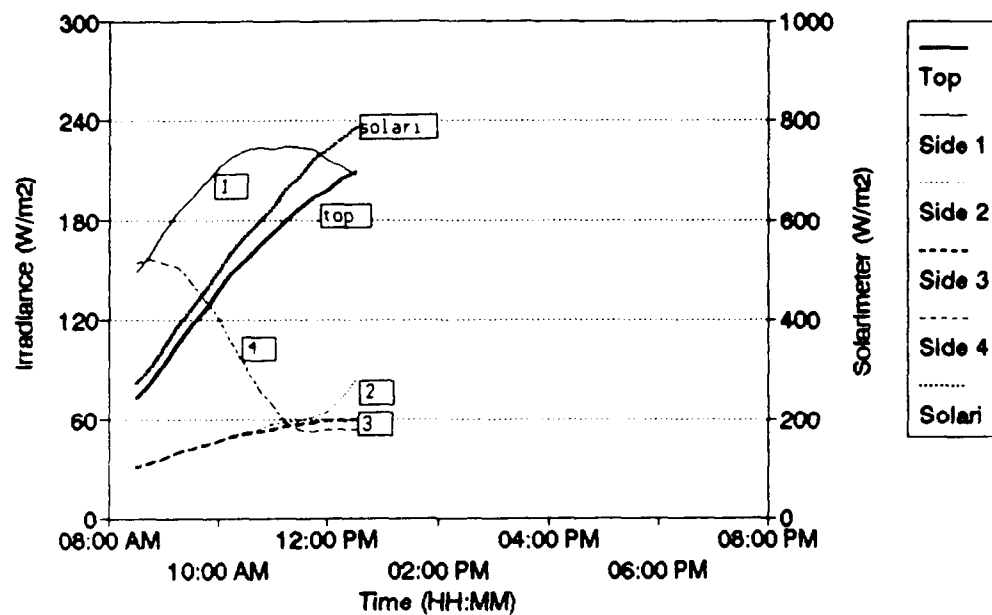


Fig 3.1c: Irradiation on five sides of a box; 03-08-1990.

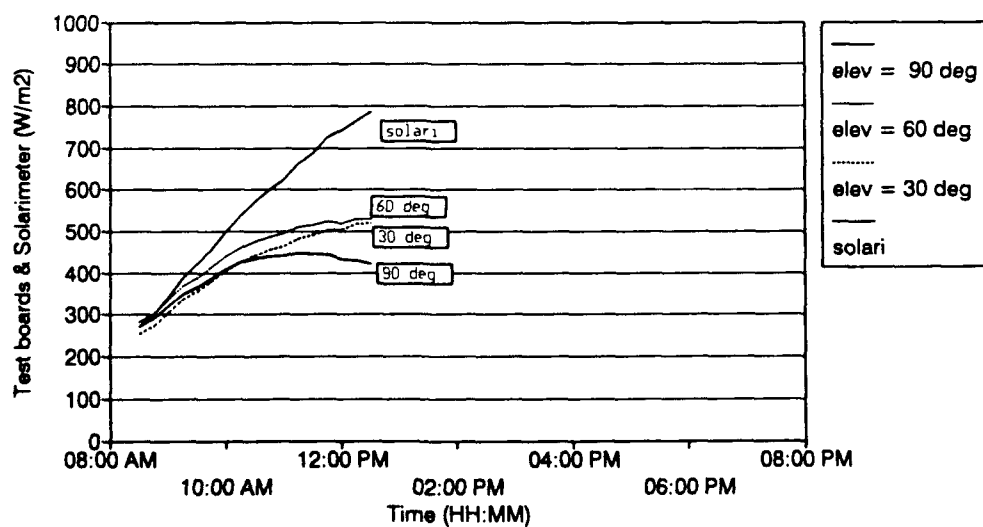


Fig 3.2c: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 03-08-1990.

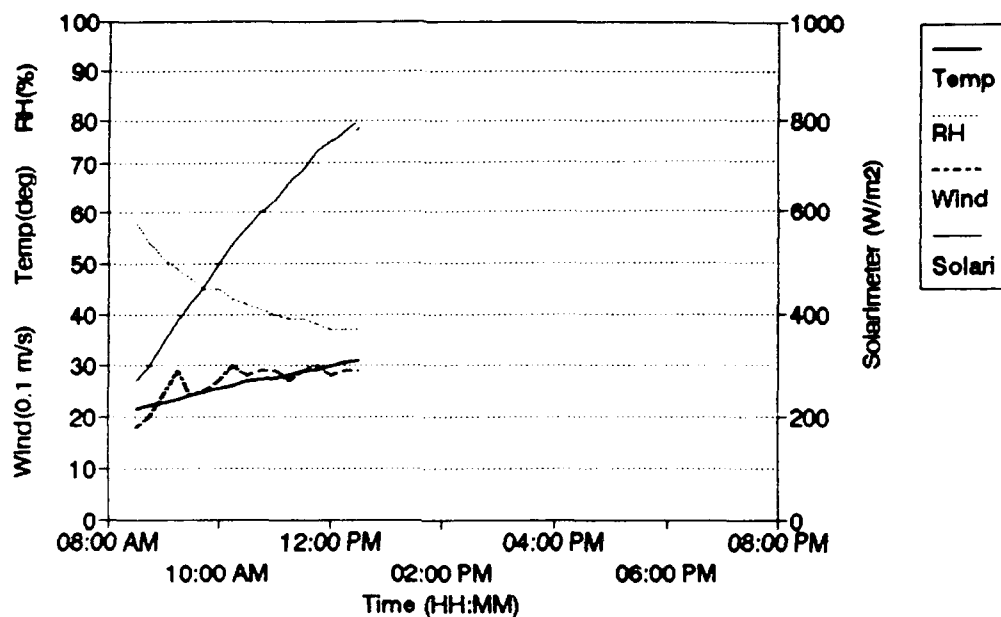


Fig 3.3e: Temperature, relative humidity, windspeed and hemispherical radiation; 03-08-1990.

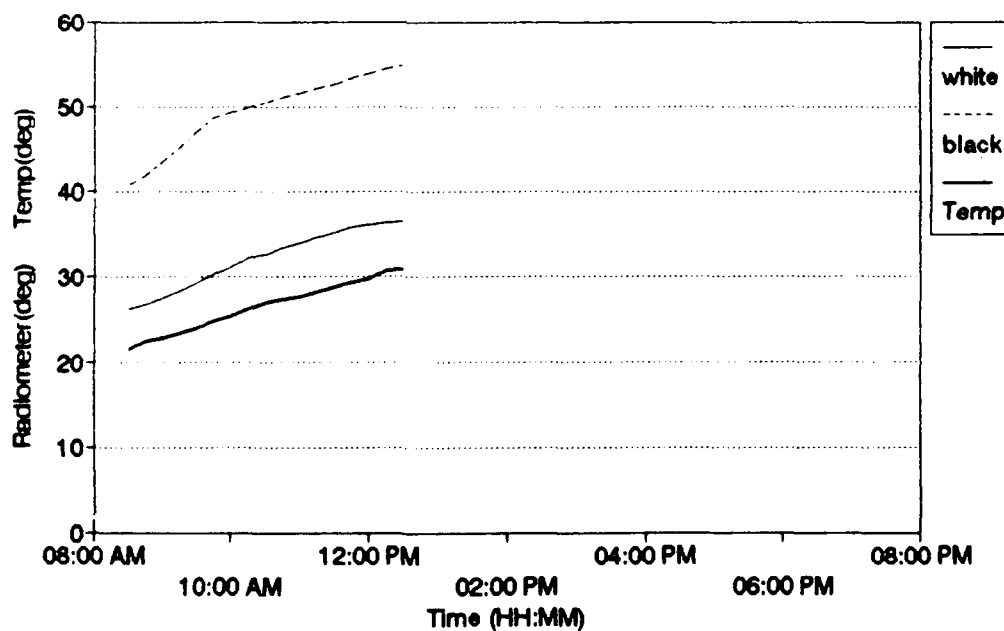


Fig 3.4e: Apparent temperature of vertical black and white board, ambient temperature; 03-08-1990.

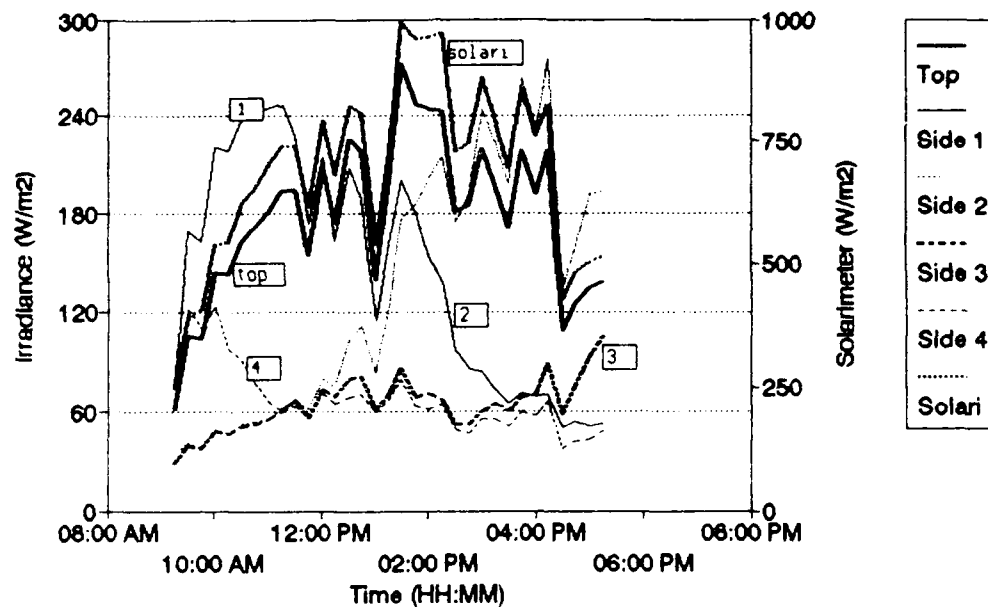


Fig 3.1f: Irradiation at five sides of a box; 06-08-1990.

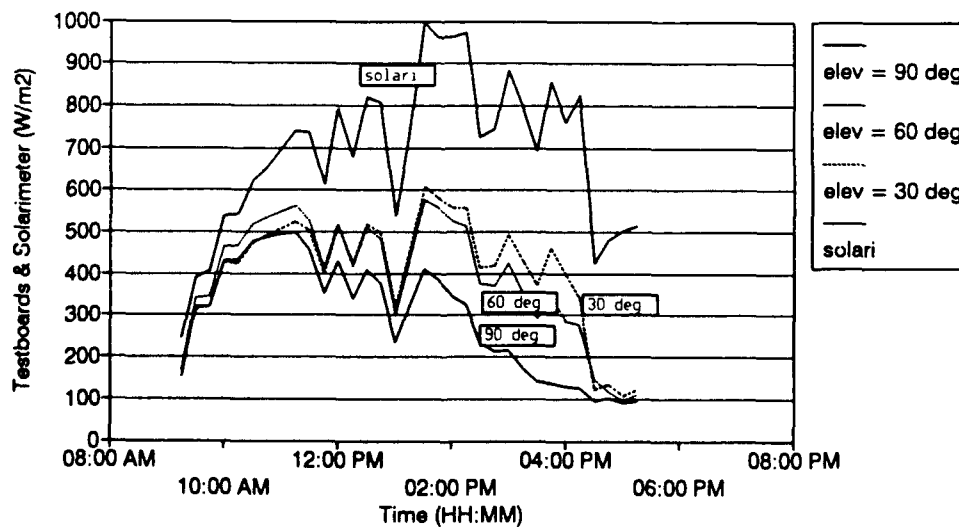


Fig 3.2f: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 06-08-1990.

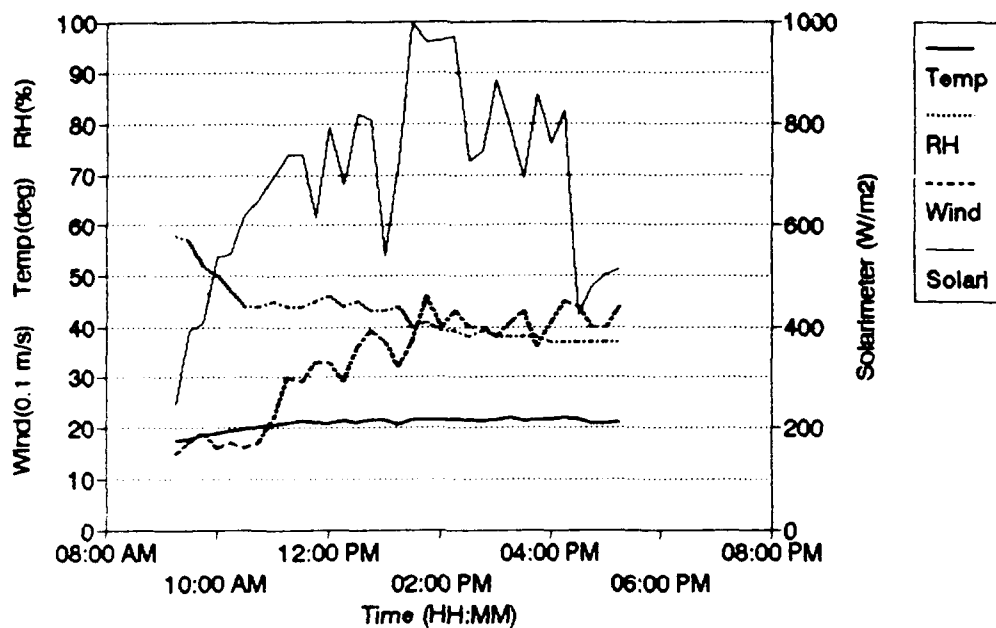


Fig 3.3f: Temperature, relative humidity, windspeed and hemispherical radiation; 06-08-1990.

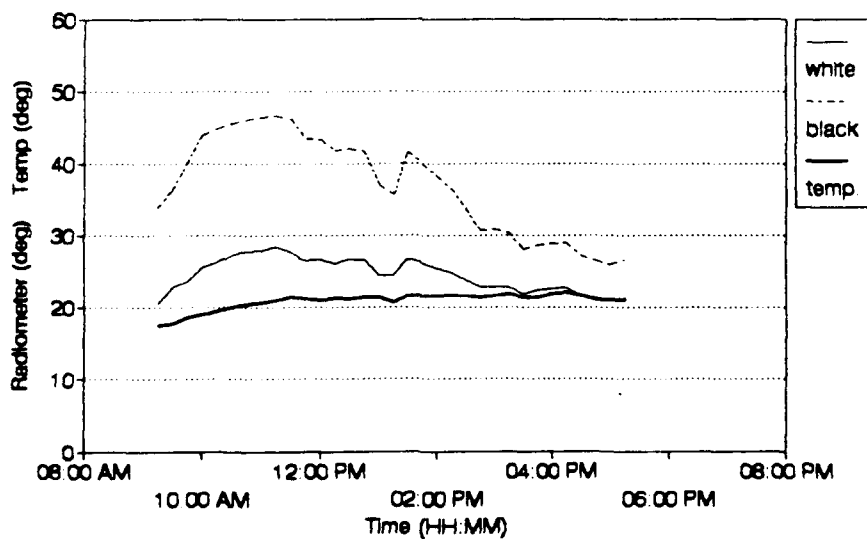


Fig 3.4f: Apparent temperature of vertical black and white board, ambient temperature; 06-08-1990.

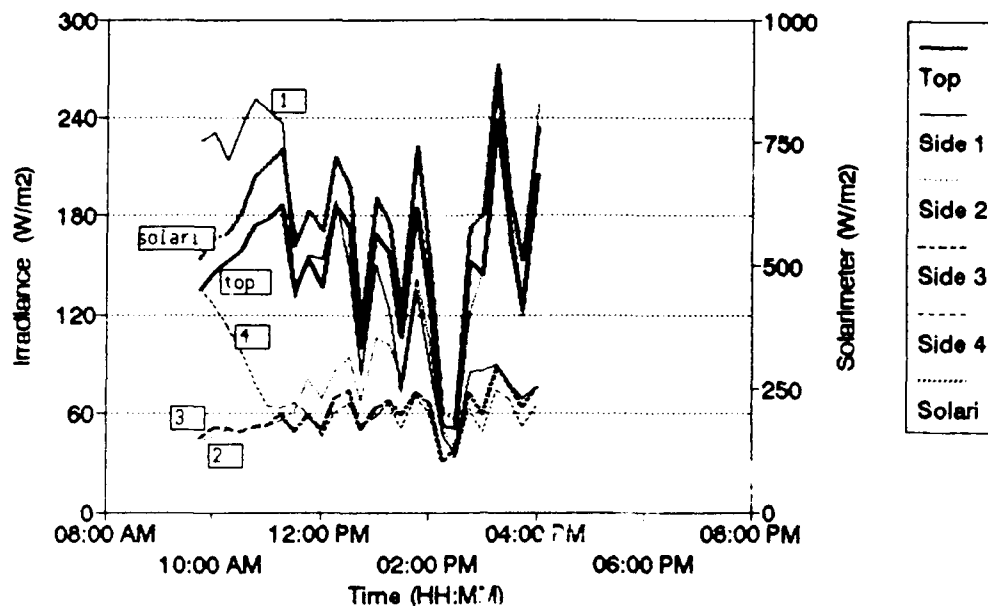


Fig 3.1g: Irradiation at five sides of a box; 07-08-1990.

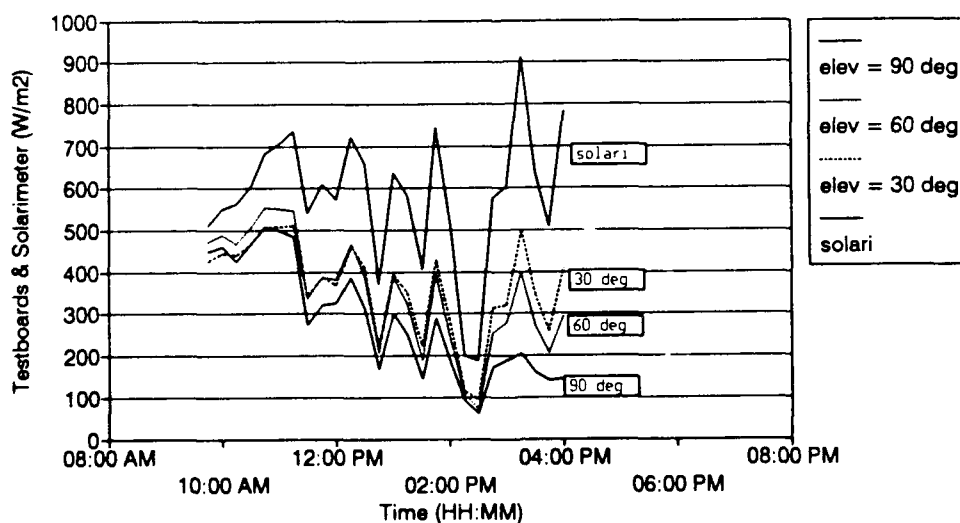


Fig 3.2g: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 07-08-1990.

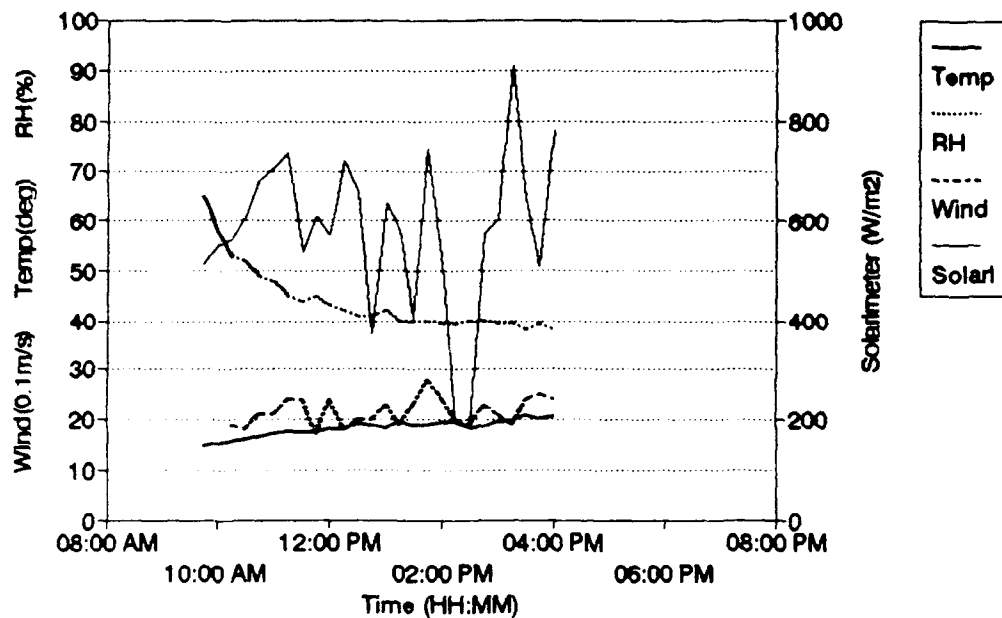


Fig 3.3g: Temperature, relative humidity, windspeed and hemispherical radiation; 07-08-1990.

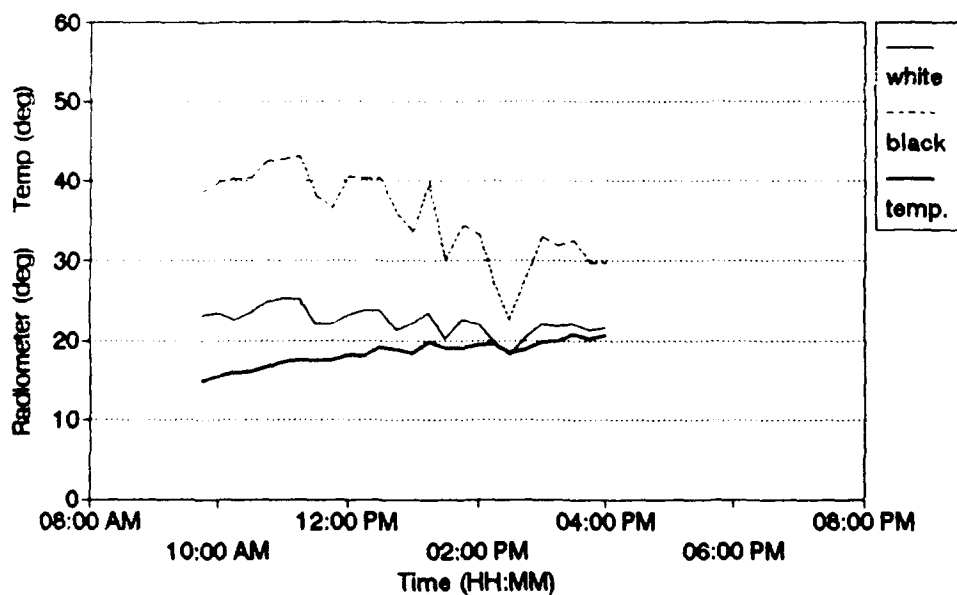


Fig 3.4g: Apparent temperature of vertical black and white board, ambient temperature; 07-08-1990.

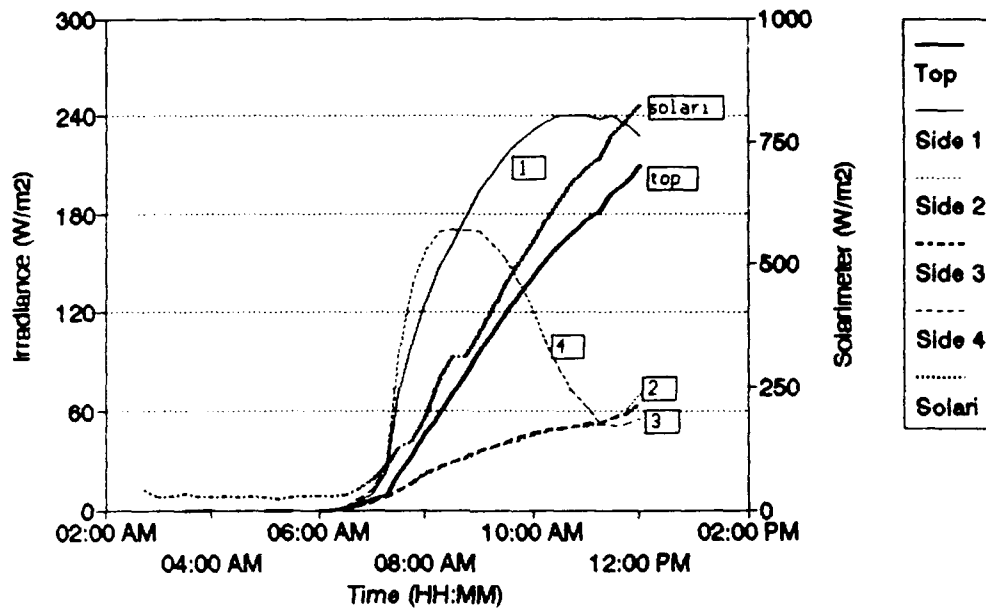


Fig 3.1h: Irradiation at five sides of a box; 08-08-1990.

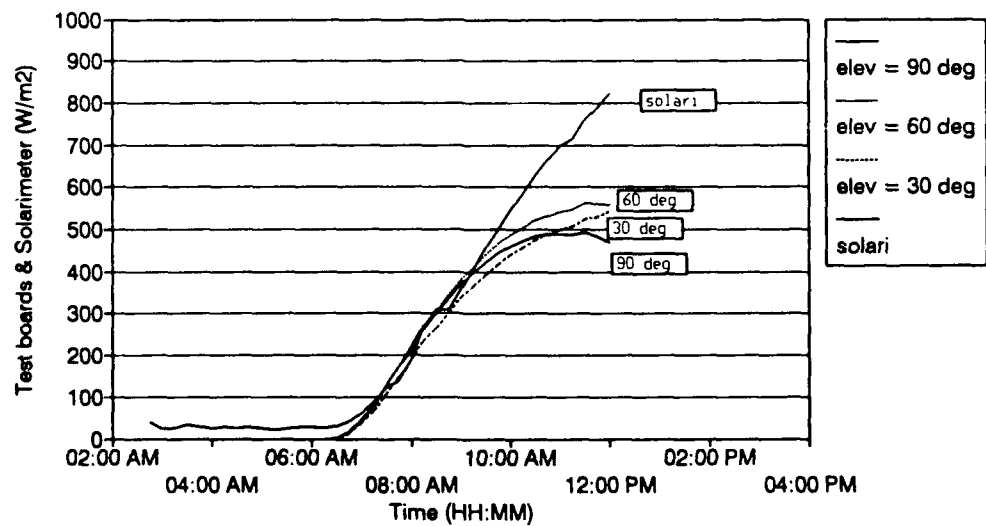


Fig 3.2h: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 08-08-1990.

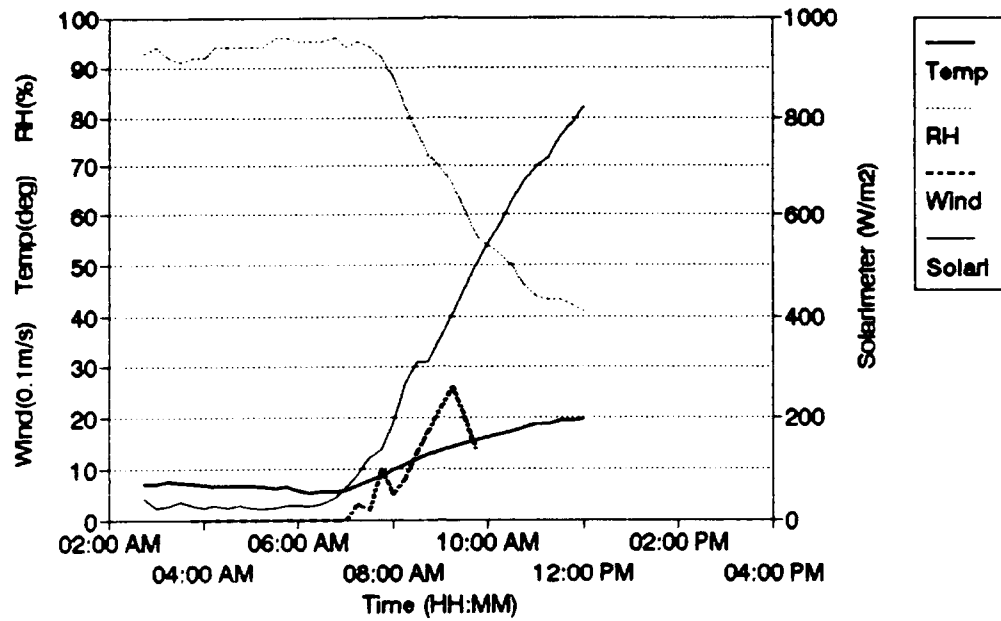


Fig 3.3h: Temperature, relative humidity, windspeed and hemispherical radiation; 08-08-1990.

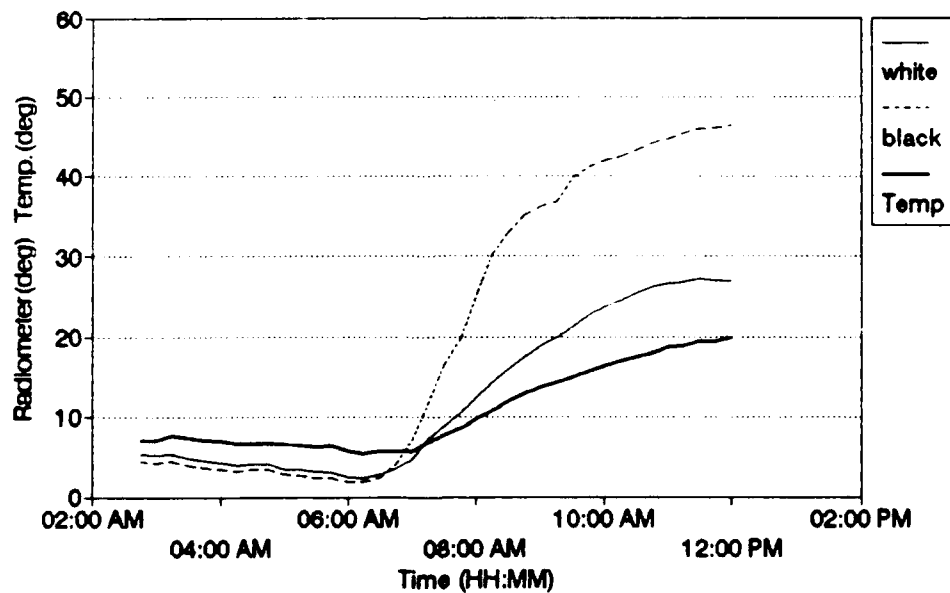


Fig 3.4h: Apparent temperature of vertical black and white board, ambient temperature; 08-08-1990.

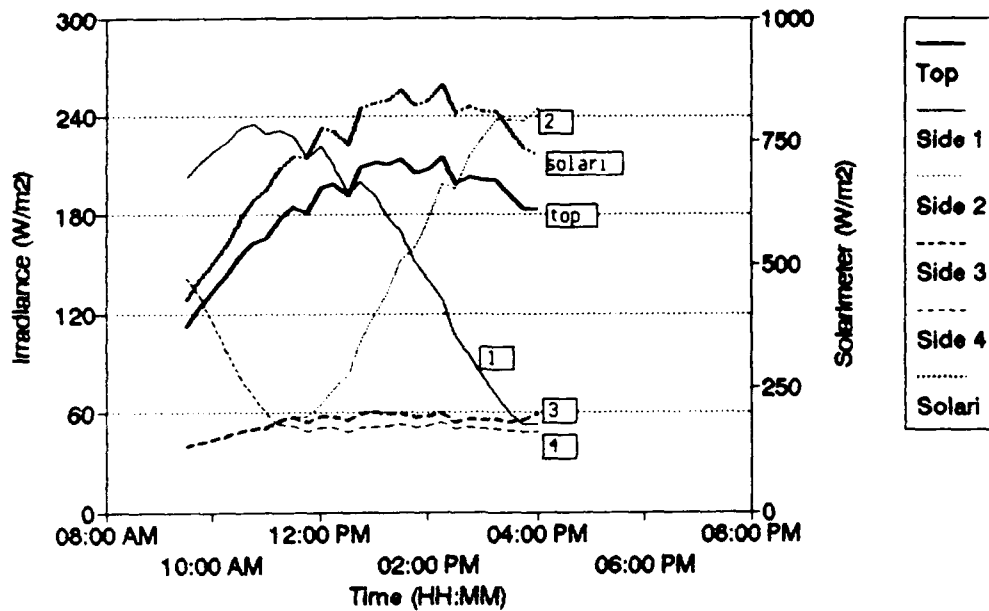


Fig 3.1i: Irradiation at five sides of a box; 09-08-1990.

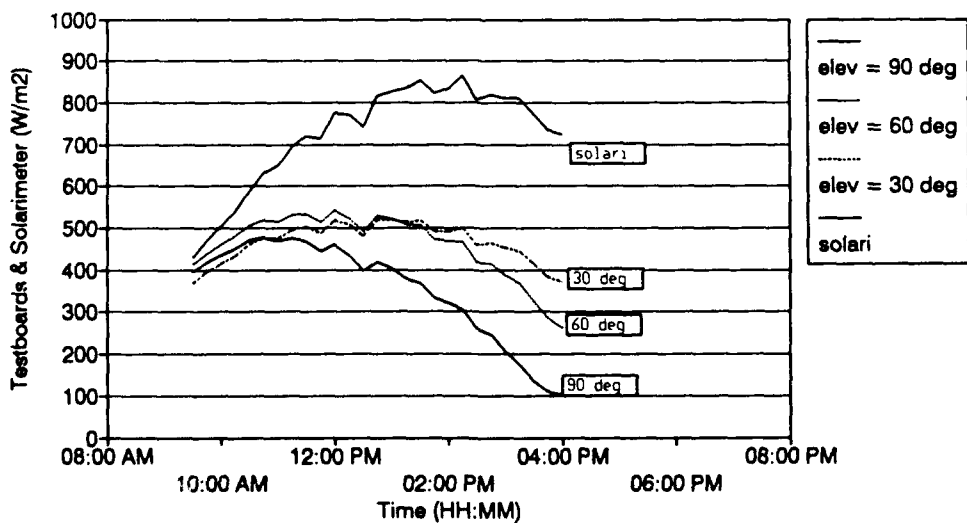


Fig 3.2i: Irradiation on boards with elevation angles of 90, 60 and 30 degrees; 09-08-1990.

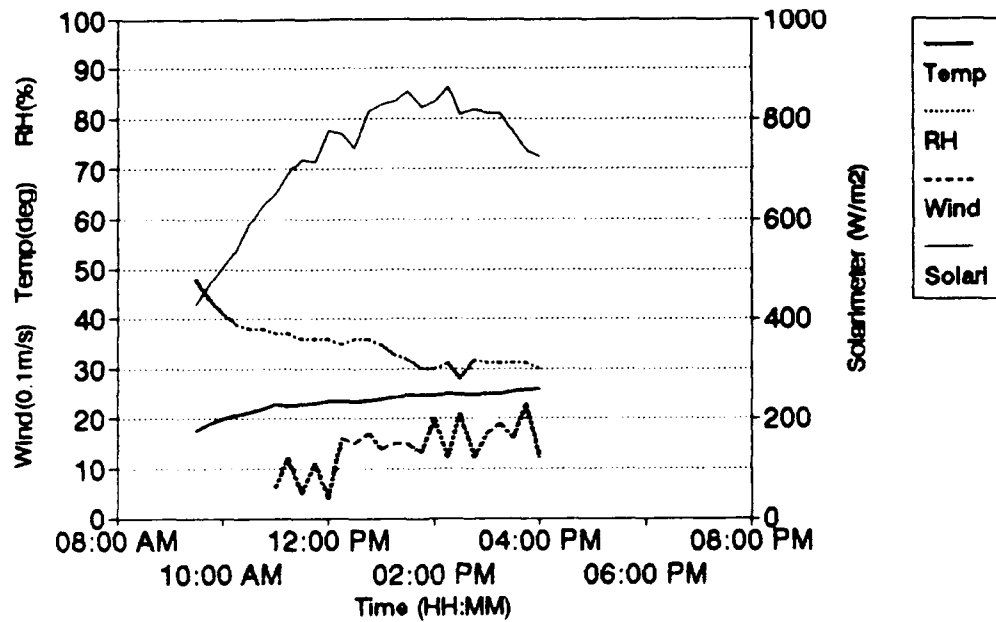


Fig 3.3i: Temperature, relative humidity, windspeed and hemispherical radiation; 09-08-1990.

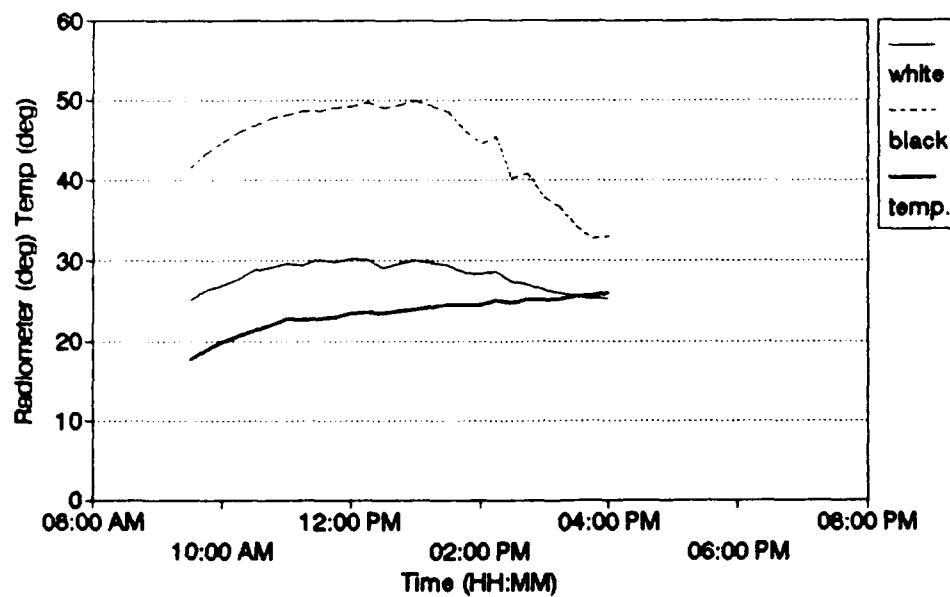


Fig 3.4i: Apparent temperature of vertical black and white board, ambient temperature; 09-08-1990.

4 REFERENCES

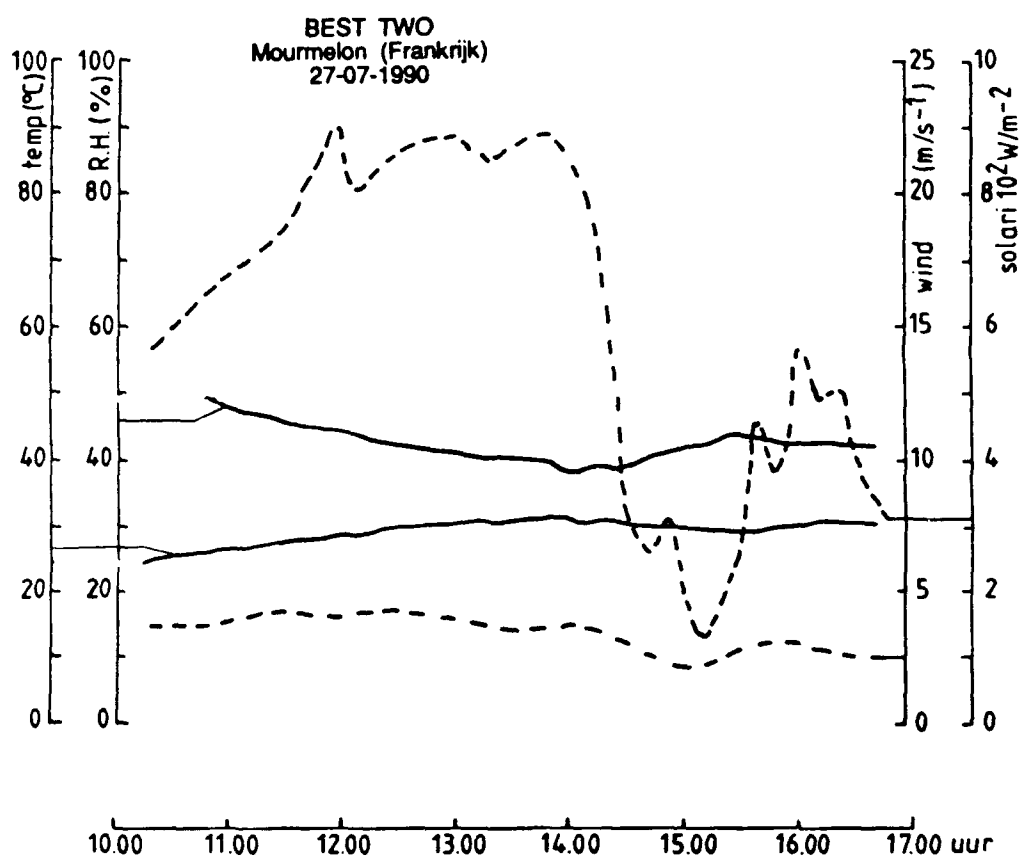
- [1] BES90: Bestley B.; BEST TWO TESTPLAN; Battlefield effects on long range (4 km) target acquisition; Camp Mourmelon (France), 23 July - 17 August 1990; NATO AC/243(panel 4/RSG 15), January 1990
- [2] DRE: Drese J.Th.; mobiel weerstation FEL

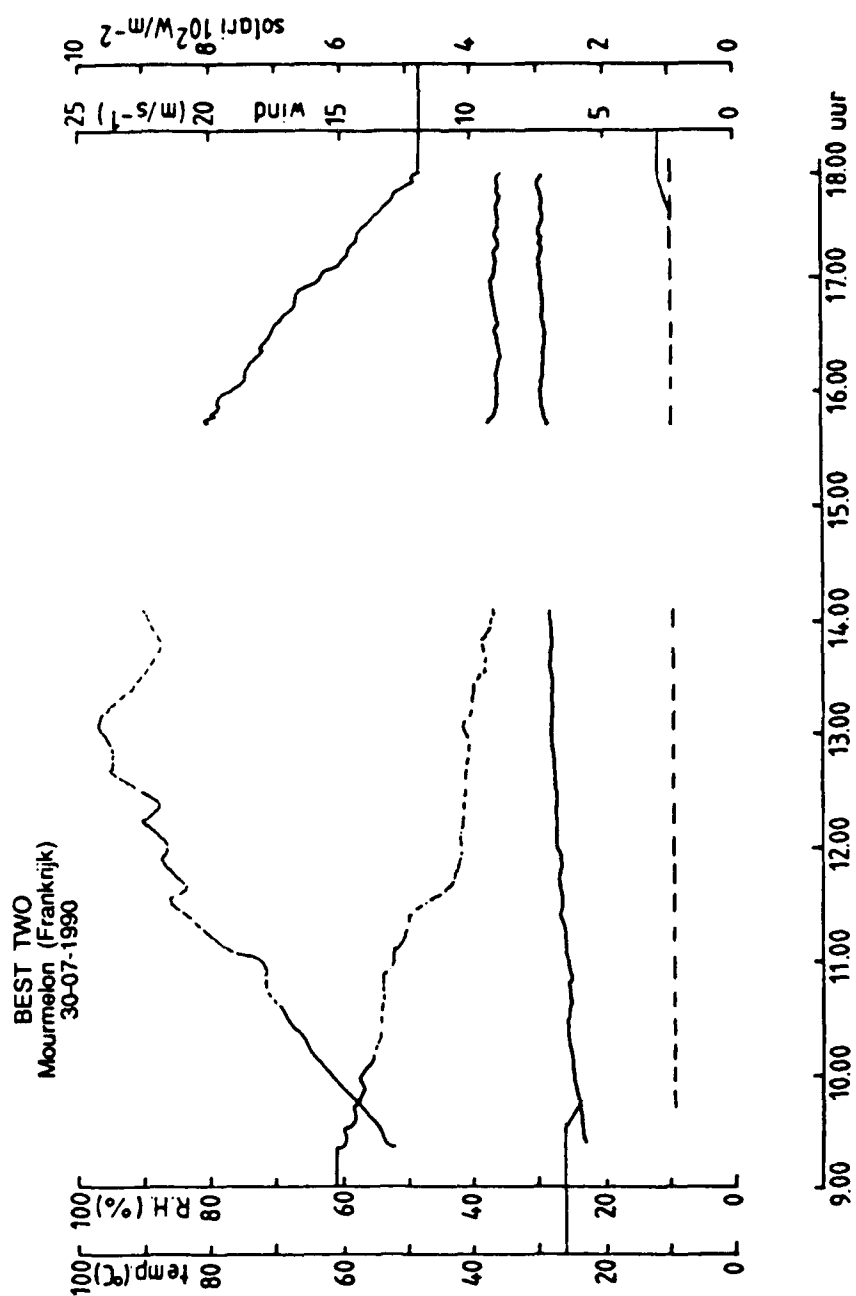
A handwritten signature in black ink, consisting of several loops and a long horizontal stroke at the end, positioned above a horizontal line.

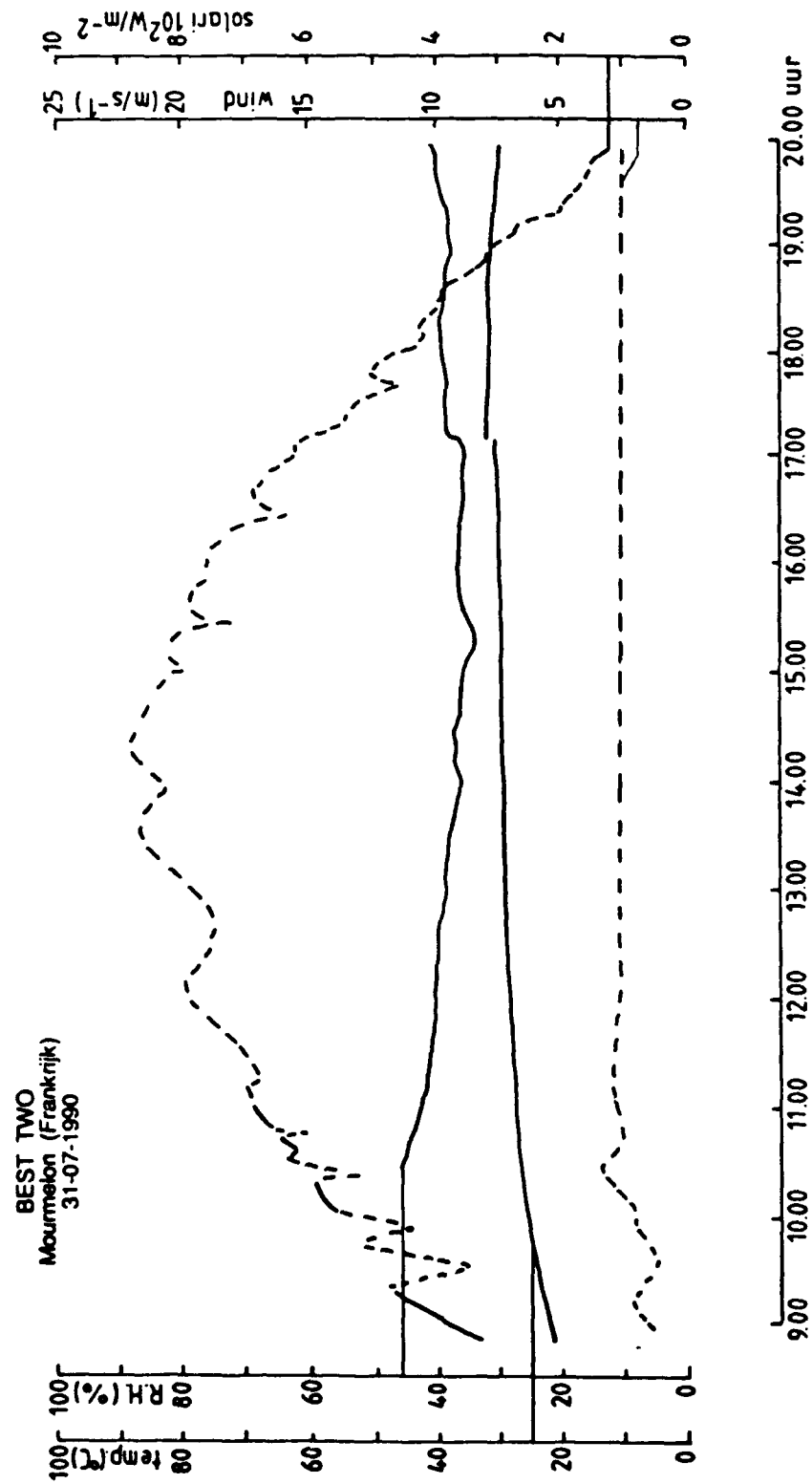
Ir. A.N. de Jong
(Group Leader)

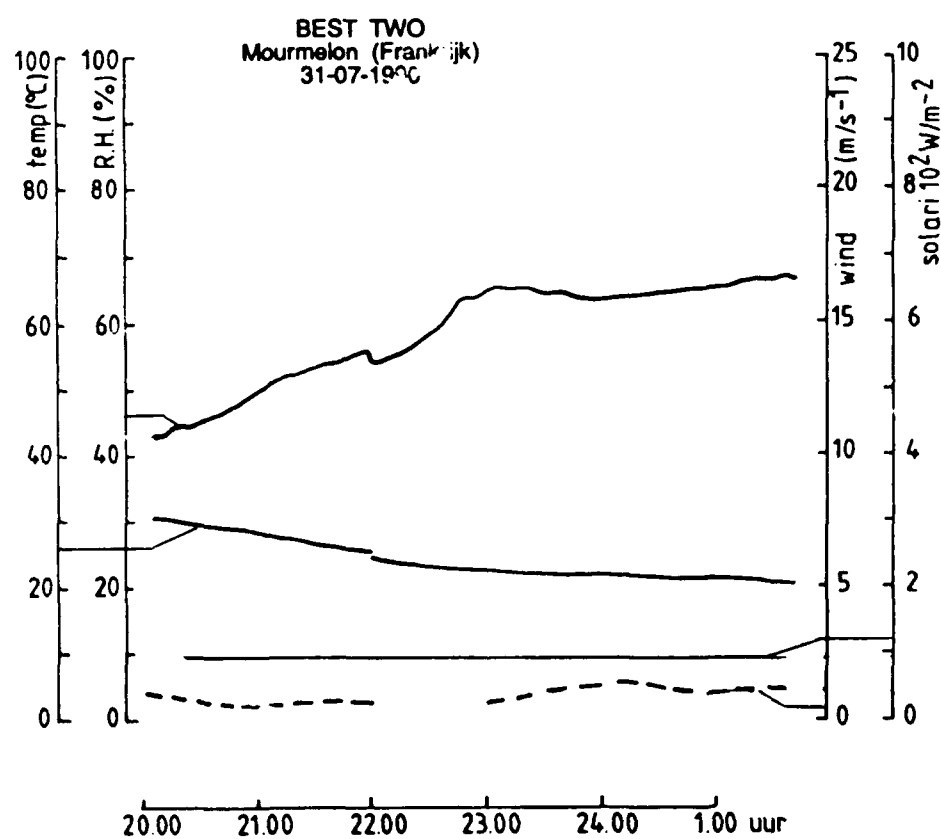
A handwritten signature in black ink, featuring a series of vertical strokes followed by a horizontal stroke, positioned above a horizontal line.

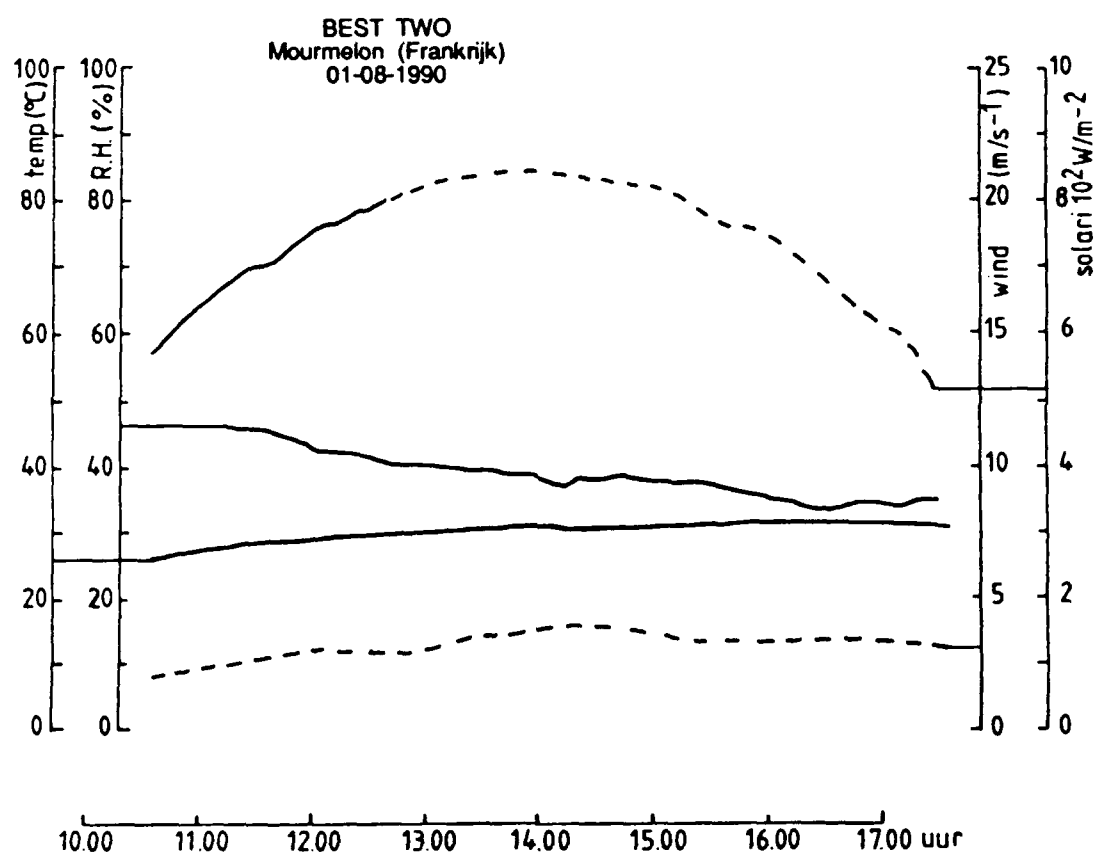
Ir. Y.H.L. Janssen
(Author)

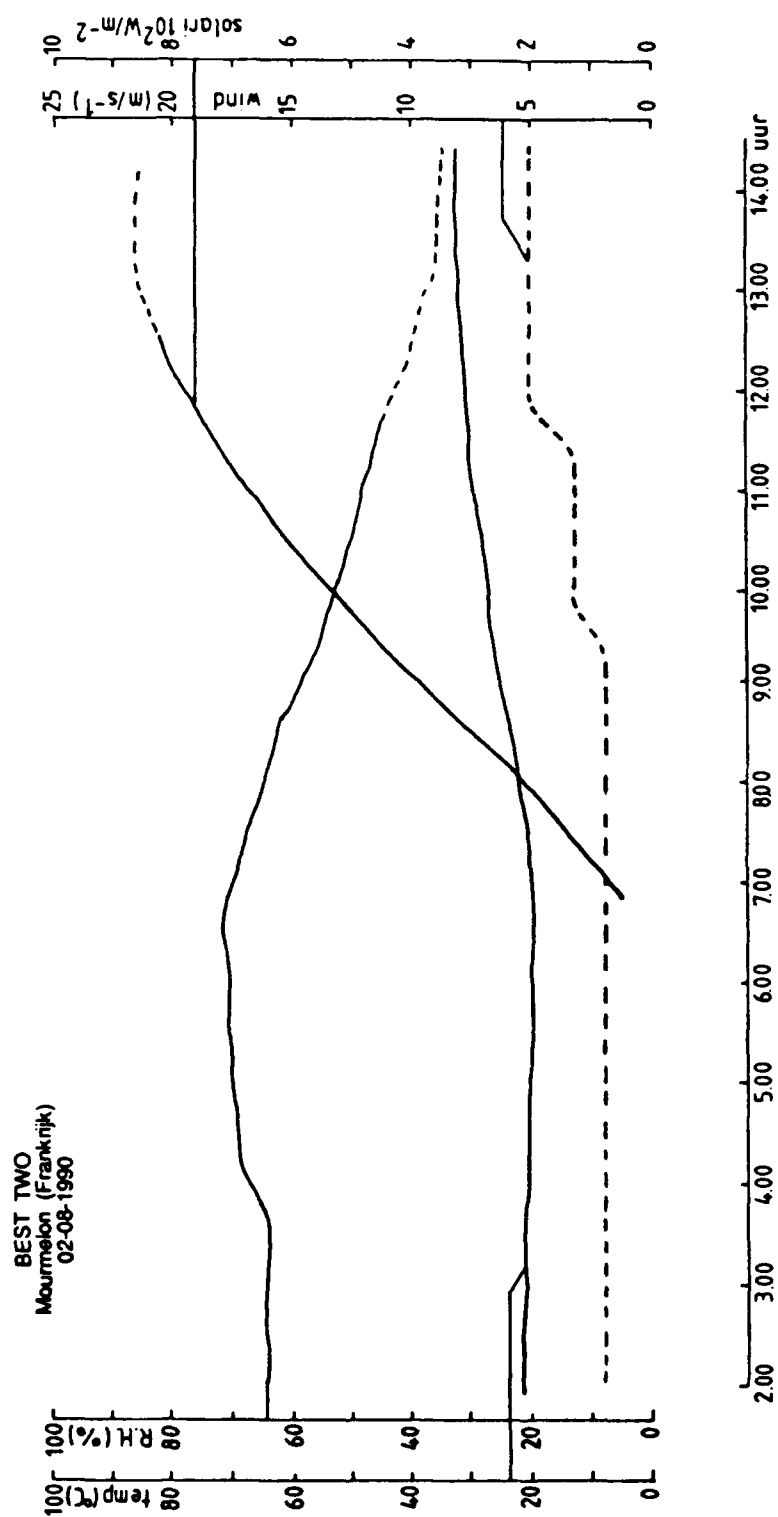


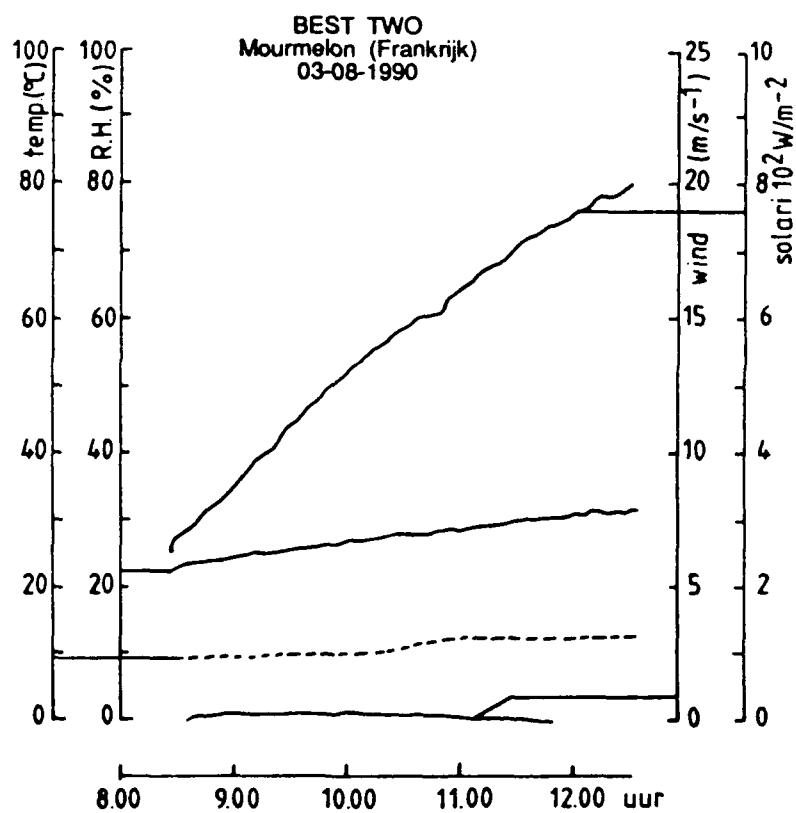


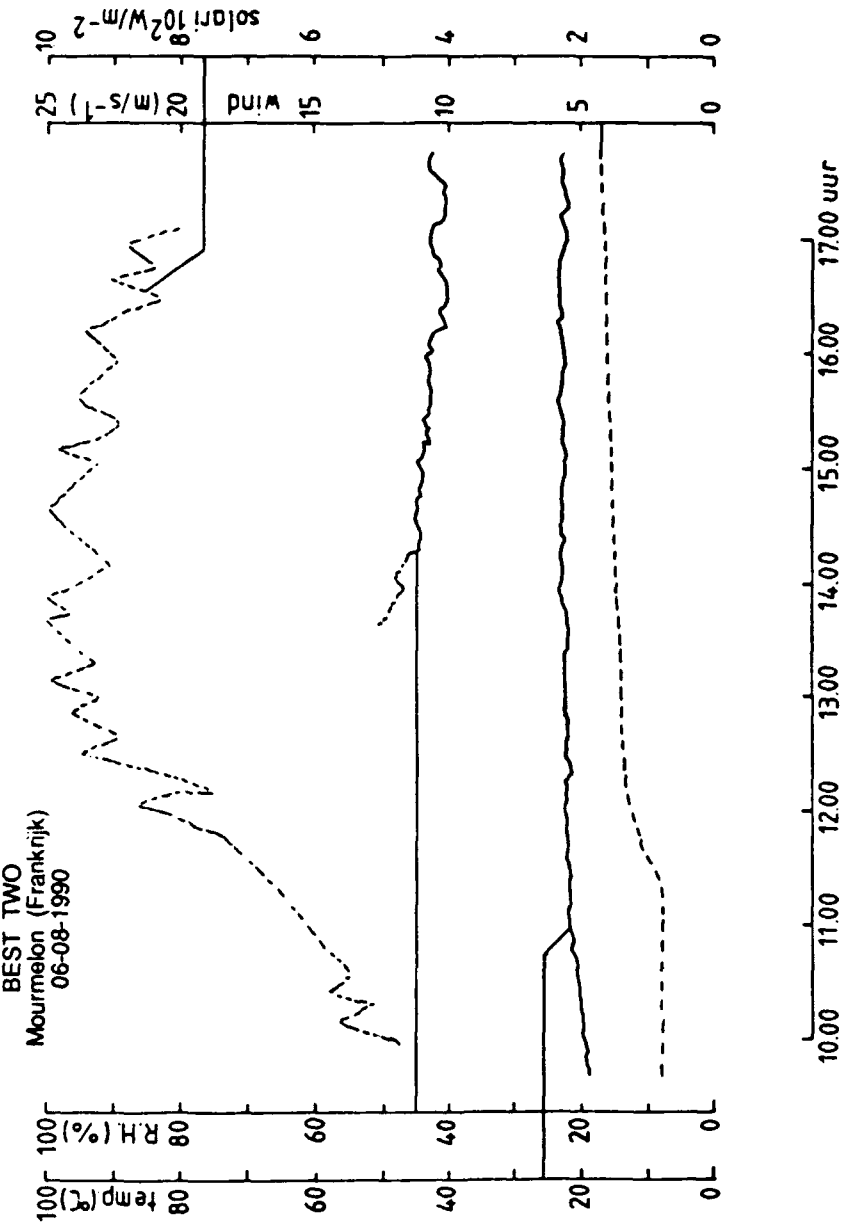


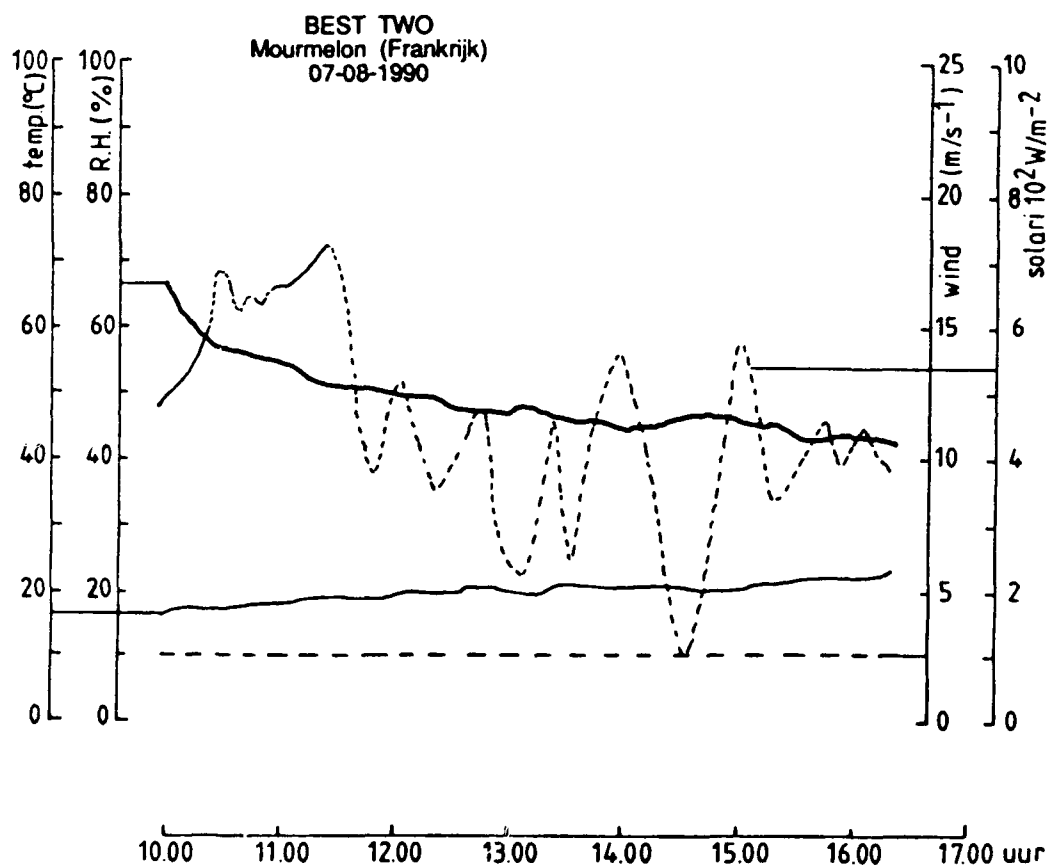


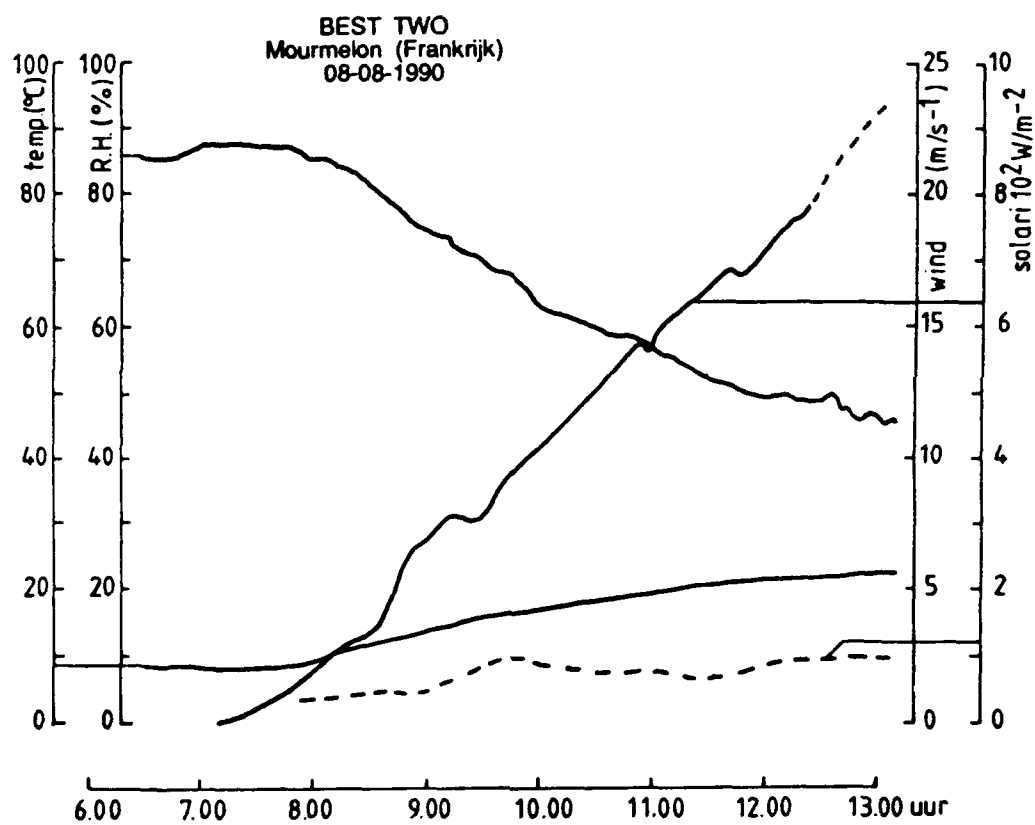


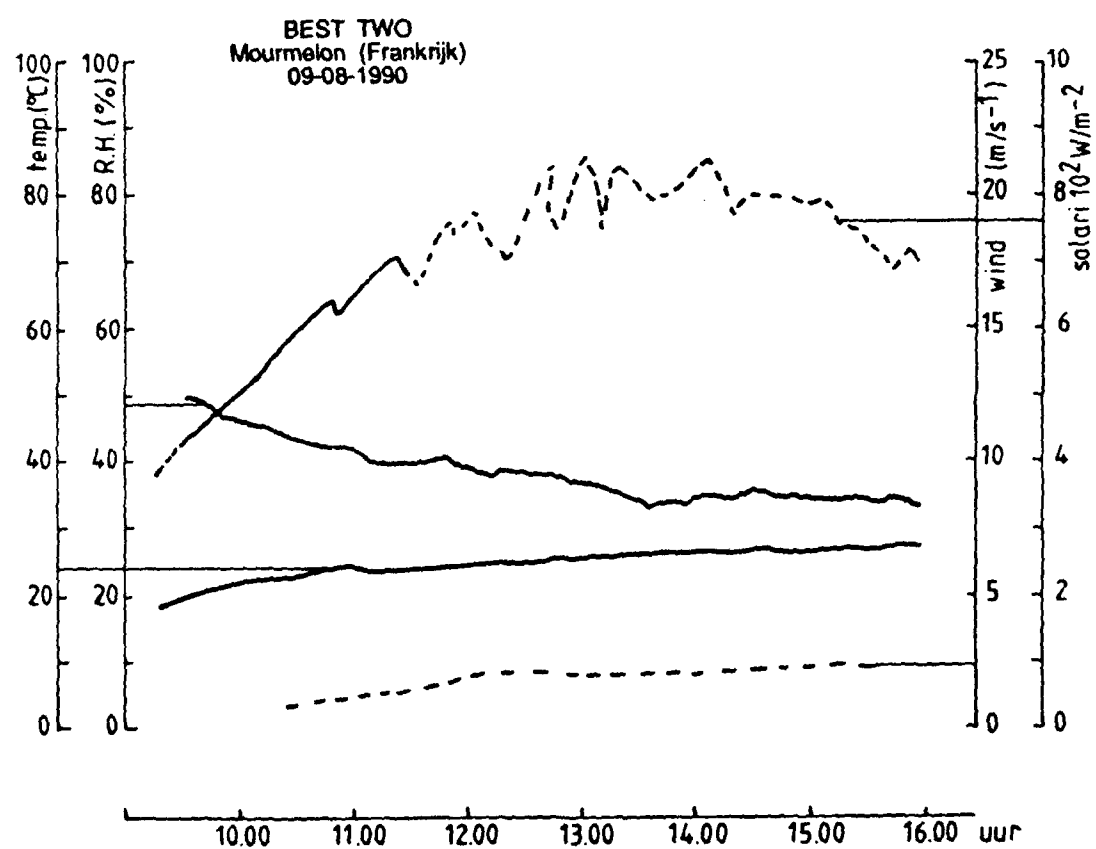












UNCLASSIFIED

REPORT DOCUMENTATION PAGE

(MOD-NL)

1. DEFENSE REPORT NUMBER (MOD-NL) TD90-0403		2. RECIPIENT'S ACCESSION NUMBER	3. PERFORMING ORGANIZATION REPORT NUMBER FEL-90-A368
4. PROJECT/TASK/WORK UNIT NO. 22062	5. CONTRACT NUMBER A90KL621	6. REPORT DATE APRIL 1991	
7. NUMBER OF PAGES 44 (INCL 1 APP & RDP.EXCL DISTR. LIST) 2		8. NUMBER OF REFERENCES	9. TYPE OF REPORT AND DATES COVERED FINAL
10. TITLE AND SUBTITLE METEO AND IRRADIATION DATA DURING BEST TWO, MOURMELON			
11. AUTHOR(S) Y.H.L. JANSSEN			
12. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) TNO PHYSICS AND ELECTRONICS LABORATORY, P.O. BOX 96864, 2509 JG THE HAGUE OUDE WAALSDORPERWEG 63, THE HAGUE, THE NETHERLANDS			
13. SPONSORING/MONITORING AGENCY NAME(S) TNO DIVISION OF NATIONAL DEFENCE RESEARCH, THE NETHERLANDS			
14. SUPPLEMENTARY NOTES THE PHYSICS AND ELECTRONICS LABORATORY IS PART OF THE NETHERLANDS ORGANIZATION FOR APPLIED SCIENTIFIC RESEARCH			
15. ABSTRACT (MAXIMUM 200 WORDS, 1044 POSITIONS) IN AUGUST 1990 THE BEST TWO EXPERIMENTS WERE HELD AT CAMP MOURMELON, ORGANISED BY NATO AC243 P04 RSG15 GROUP. DURING THEIR MEASURING PERIODS THE RESEARCH GROUP INFRARED (IR) OF FEL TNO (NETHERLANDS) COLLECTED SEVERAL METEO AND IRRADIATION DATA FOR SUPPORT AND VALIDATION OF THEIR TRANSMISSION, VISUAL AND INFRARED CONTRAST EXPERIMENTS. METEO DATA CONSIST OF AMBIENT TEMPERATURE, RELATIVE HUMIDITY AND WINDSPEED. VISUAL HEMISPHERICAL RADIATION ON A HORIZONTAL SURFACE IS MEASURED TOGETHER WITH VISUAL RADIATION ON FIVE SIDES OF A CUBE (TOP AND FOUR VERTICAL SIDES) AND VISUAL IRRADIATION ON THREE BOARDS WITH ELEVATION ANGLES OF 90, 60 AND 30 DEGREES. FOR SUPPORT OF EXPERIMENTS IN THE INFRARED WAVELENGTH RANGE, APPARENT TEMPERATURES OF A VERTICAL BLACK AND WHITE BOARD WERE MEASURED.			
16. DESCRIPTORS SOLAR RADIATION MEASUREMENTS INFRARED RADIATION MEASUREMENTS		IDENTIFIERS APPARENT TEMPERATURE MEASUREMENTS	
17a. SECURITY CLASSIFICATION (OF REPORT) UNCLASSIFIED	17b. SECURITY CLASSIFICATION (OF PAGE) UNCLASSIFIED	17c. SECURITY CLASSIFICATION (OF ABSTRACT) UNCLASSIFIED	
18. DISTRIBUTION/AVAILABILITY STATEMENT UNLIMITED AVAILABILITY		17d. SECURITY CLASSIFICATION (OF TITLES) UNCLASSIFIED	

UNCLASSIFIED